FEB. 1987 Issue #317

73® Amateur Radio

USA $2.95
CAN $3.95
A WGE Publication

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ICOM 1.2GHz

THE ONLY 1.2GHz SYSTEM... ANYWHERE

- **IC-1271A Base Station**
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- **IC-RP1210 Repeater**

Explore 1.2GHz with ICOM. Only ICOM offers the most complete line of ham gear for 1.2GHz...the IC-1271A full-featured base station transceiver, the new IC-12AT handheld, the IC-120 mobile and the IC-RP1210 repeater. So, get away from the crowd and be a pioneer on 1.2GHz.

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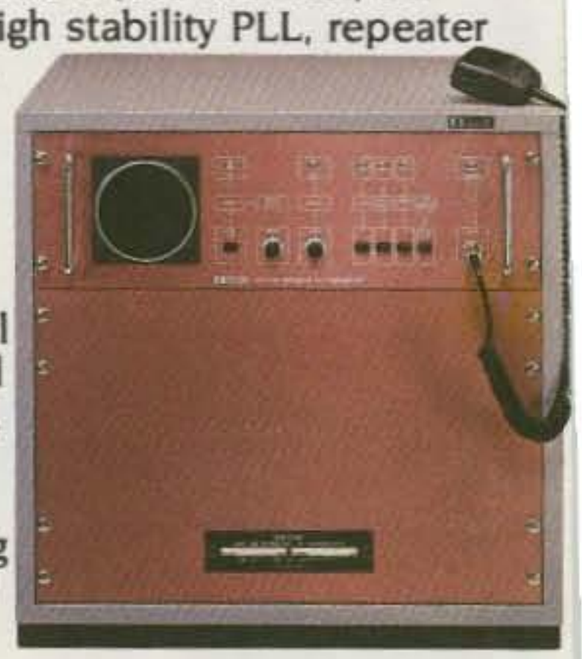
A variety of options are available for the IC-1271A including the IC-EX310 voice synthesizer, UT15S CTCSS encoder/decoder, IC-PS25 internal AC power supply, AG1200 preamplifier and the TV1200 TV interface unit.

TV-1200

The new IC-12AT covers from 1260–1299.990MHz, has ten memory channels, memory scan, program scan and programmable offset. It also features an LCD readout, RIT and VXO, 32 built-in tones and a DTMF pad.

The IC-120 1.2GHz mobile transceiver has six memory channels, scanning, an HM-14 up/down scanning mic, RIT, LED readout and three tuning rates. Accessories include the ML12 10 watt amplifier and the PS45 slimline external power supply.

The IC-RP1210 completes your 1.2GHz system. It features a field programmable (198 channel, DIP switch), high stability PLL, repeater access to CTCSS, three-digit DTMF decoder for control of special functions, 10 watts, selectable hang time and ID'er.



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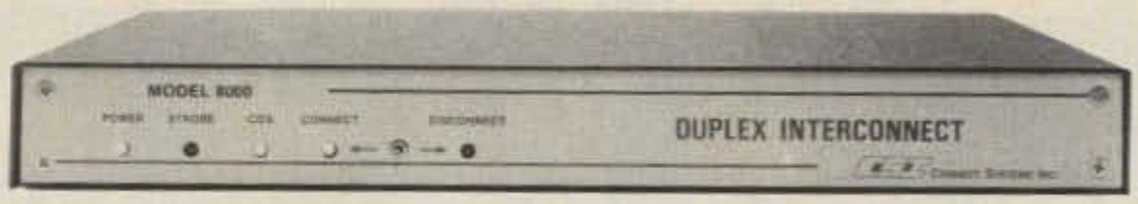
MODEL 8000 DUPLEX



- Desk top or rack mounted versions
- Pulse or fully regenerated tone dialing
- Full and half duplex operation
- Half duplex privacy mode
- Internally squelched audio
- Powerful toll call protection
- Secret toll override code
- ✱ up # down or multi-digit access
- Ringout
- End to end signalling (DTMF standard)
- Auto answer on 1st, 2nd, 4th or 8th incoming ring
- Mobile to mobile signalling
- Telephone initiated control mode
- Dip switch selectable hybrid compensation capacitance.
- Programmable timout and mobile activity timers with unique beeps
- Disconnect beep
- Separate repeat level control
- Lightning protection
- Connectors for options
- 10-16VDC powered

28 dip switches make all features user programmable and selectable.

OPTIONS

8001 ANI code validator (up to 1024 access codes)
8002 1000 call two tone signalling
8003 32 call CTCSS signalling
8004 FCC registered coupler
8005 Centralized computer billing system

NOW ANYONE CAN ENJOY FULL DUPLEX!

Merely connect a CSI Model 8000 to any duplex base (such as the Yaesu FT-2700RH) and presto. . . you have an instant full duplex mobile telephone system!

Or, the 8000 can be connected to any repeater for shared use. A landline caller can selectively call any mobile on the system with (end to end) regenerated DTMF (standard), CTCSS (optional) or two tone sequential (optional). Mobiles can even selectively call **each other**!

Knowing the correct code, a caller can **take control** of the 8000 from any touch phone and **voice communicate** with mobiles that are not equipped with touch dialers.

No other duplex patch offers so much for so little.

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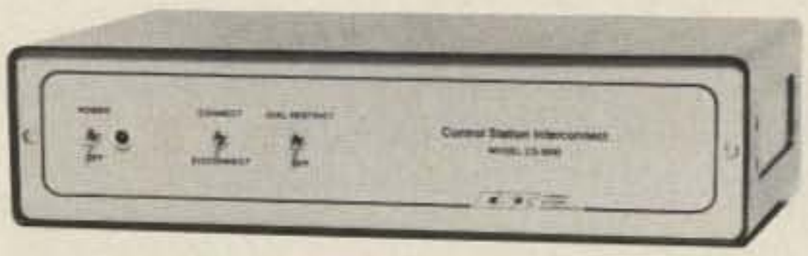
A high performance VOX based patch for simplex systems and for operation through remotely located repeaters.

Thousands of Private Patch III's are in both amateur and commercial use worldwide. Private Patch III enjoys a reputation that is second to none.

CW ID and other powerful features make Private Patch III the best deal going in Vox Simplex phone patches!

MODEL CS-9500



For exemplary simplex performance, the CS-9500 control station interconnect incorporates a full ½ second of landline to mobile electronic voice delay. Voice delay assures compatibility with the slowest CTCSS or trunked repeater systems.

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EXPIRATION DATE

SIGNATURE REQUIRED IF USING CREDIT CARD _____

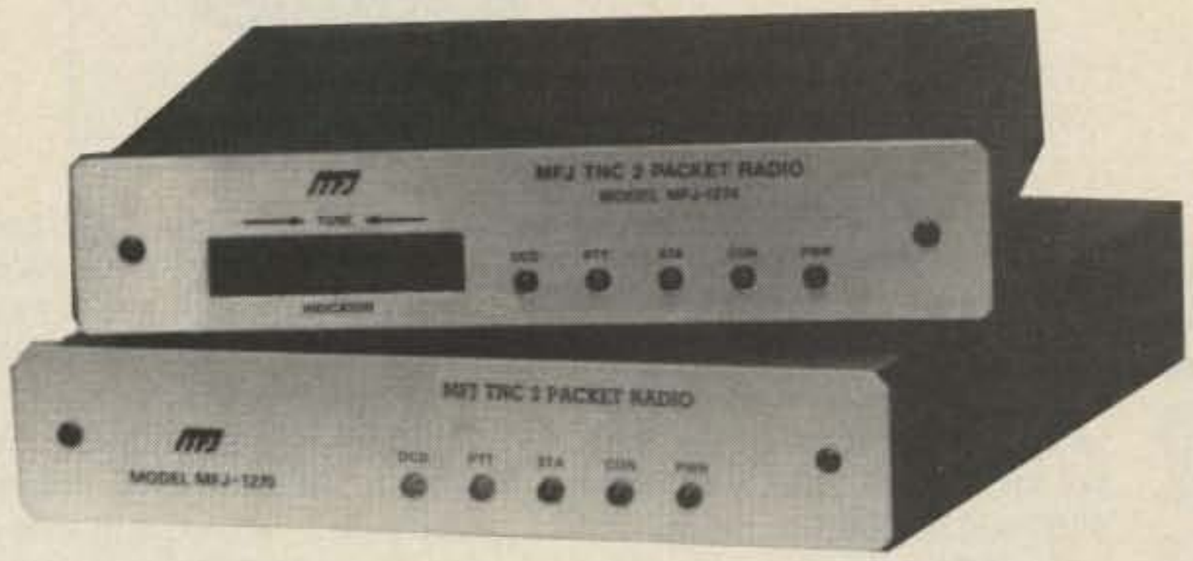
253

New MFJ-1274 lets you work VHF and HF packet with built-in tuning indicator for $169.95 . . .

. . . you get MFJ's latest clone of TAPR's TNC-2, TAPR's VHF/HF modem and built-in tuning indicator that features 20 LEDs for easy precise tuning

MFJ-1274
$169.95

MFJ-1270
$139.95



Now you can join the exciting world of packet radio on both VHF and HF bands with a precision tuning indicator . . . for an incredible $169.95!

You get MFJ's top quality clone of the highly acclaimed industry standard TAPR TNC-2. We've made TAPR's modem selectable for both VHF and HF operation, added their precision 20 segment LED tuning indicator, a TTL serial port, an easily replaceable lithium battery for memory back-up and put it all in a new cabinet.

If you don't need the tuning indicator or the convenience of a switchable VHF/HF modem, choose the affordable MFJ-1270 for $139.95.

All you need to operate packet radio is a MFJ-1274 or MFJ-1270, your rig, and any home computer with a RS-232 serial port and terminal program.

If you have a Commodore 64, 128, or VIC 20 you can use MFJ's optional Starter Pack to get on the air immediately. The Starter Pack includes interfacing cable, terminal software on disk or tape and complete instructions . . .everything you need to get on packet radio. Order MFJ-1282 (disk) or MFJ-1283 (tape), $19.95.

Unlike machine specific TNCs you never have to worry about your MFJ-1274 or MFJ-1270 becoming obsolete because you change computers or because packet radio standards change. You can use any computer with an RS-232 serial port with an apropriate terminal program. If packet radio standards change, software updates will be made available as TAPR releases them.

Also speeds in excess of 56K bauds are possible with a suitable external modem! Try that with a machine specific TNC or one without hardware HDLC as higher speeds come into widespread use.

You can also use the MFJ-1274 or MFJ-1270 as an excellent but inexpensive digipeater to link other packet stations.

Both feature AX.25 Level 2 Version 2 software, hardware HDLC for full duplex, true Data Carrier Detect for HF, multiple connects, 256K EPROM, 16K RAM (expandable to 32K with optional EPROM), simple operation, socketed ICs plus much more.

You get an easy-to-read manual, a cable to connect your transceiver (you have to add a connector for your particular radio), a connector for the TTL serial port and a power supply for 110 VAC operation (you can use 12 VDC for portable, remote or mobile operation).

Help make history! Join the packet radio revolution now and help spread this exciting network throughout the world. Order the top quality and affordable MFJ-1274 or MFJ-1270 today.

MFJ-1273, $49.95

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The MFJ-1273 tuning indicator plugs into the MFJ-1270 and all TNC-1s, TNC-2s and clones that have the TAPR tuning indicator connector.

24

Order any product from MFJ and try it -- no obligation. If not satisfied return within 30 days for prompt refund (less shipping).
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Number 20 on your Feedback card

A VERY BAD IDEA?

Just as the news of gold brought hundreds of thousands of Americans to California a hundred years ago, we're seeing a feeding frenzy of greed gathering behind the idea of selling off lesser needed ham frequencies and splitting the money among the few of us amateurs who are still left.

To get a handle on the actual value of our ham bands, you should know that the Metromedia cellular license is up for sale for $1.2 billion. The value of a radio channel has to do with how much income can be derived from it. My calculator doesn't have enough digits to work out the value of a TV channel—which can be sold in 50 to 100 markets, each one worth billions.

Let's see, if we sold off one of our ham bands, say the 420–450-MHz band, and we only got $10 million per channel instead of $1 billion—figuring 20 kHz per channel and thus 50 channels per MHz—we'd have about 1,500 channels to sell, times at least 50 markets, a total of 75,000 channels. Heck, if we marked 'em down to $10 million per channel for a quick sale, we'd have $750,000,000,000 to split up.

The FCC says there are about 420,000 of us. However, the latest *73* subscription mailing brought back a 12.5% return marked "deceased." That brings the number of live amateurs down to around 360,000. Further, I see no reason why we should even think of splitting the pot with hams who are so little interested in the hobby that they aren't active—which brings us down to more like 175,000. This would net about $4.3 million each. Now the question is, would you swap our wonderful 450-MHz band for a lousy one-time $4.3 million for yourself? Not darned likely, right? Heck, after taxes you'd only have about $2.7 million at the new 38% tax rate. If you're able to invest this for a return of 8% per year, you'd have $216,000 which after taxes would be more like $134,000—which isn't as much as it sounds. Piddling.

With decent houses going in the millions, even rather ordinary yachts over a million, and many cars in the $125,000 range, you'd have to watch your expenses carefully just to get by. You might even want to settle for a Taiwan-made Rolex instead of a Swiss.

But, I argue, this is ridiculous—here we're talking of selling a priceless heritage. Well sure, they say, but since we aren't bothering to keep the hobby alive by attracting youngsters, we're going to lose it anyway when the last few amateurs die off in a few years. So why not get what we can for it now and take up some other hobby? If we sold off even one ham band, every ham could retire today and live off the income from investments. Live frugally perhaps, but live. Imagine what we could make by selling all of 'em!

One bunch of contentious old-timers has been arguing that the proceeds of selling our ham bands shouldn't really be split evenly, but should be apportioned on the basis of seniority. For instance, I've been at it for 48 years, so I would get 48 shares of the pot. A new Novice might get one share. I don't know just why, but this proposition has a subtly attractive aspect.

If we're going to divvy things up on that sort of basis, perhaps we should provide extra credits for hams who were active during the years when amateur radio was benefitting the world—back before the Incentive Licensing proposal brought the hobby to a complete halt in 1964. Perhaps double points for years before 1964 would even things a bit. This would give me 76 shares instead

Continued on page 10

QRM

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Contract: What kind of dummy wastes time reading the fine print of the postal statement? Wayne, Perry, and the others write their poor hearts out for you and here you are instead reading this bunk. What further proof is needed that hams are crazy? Case closed.

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Good for Satellite Digital QSOs

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- **40 multi-function memories.**
  Stores frequency, mode, repeater offset, and CTCSS tone. Memories are backed up with a built-in lithium battery.

- **Versatile scanning functions.**
  Programmable band and memory scan (with channel lock-out). "Center-stop" tuning on FM. An "alert" function lets you listen for activity on your priority channel while listening on another frequency. **A Kenwood exclusive!**
- **RF power output control.**
  Continuously adjustable from 2 to 25 watts.
- **Automatic mode selection.**
  You may select the mode manually using the front panel mode keys. Manual mode selection is verified in International Morse Code.
- **All-mode squelch.**
- **High performance noise blanker.**
- **Speech processor.**
  For maximum efficiency on SSB and FM.
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  More TS-711A/811A information is available from authorized Kenwood dealers.

Optional accessories.

- IF-10A computer interface
- IF-232C level translator
- CD-10 call sign display
- SP-430 external speaker
- VS-1 voice synthesizer
- TU-5 CTCSS tone unit
- MB-430 mobile mount
- MC-60A, MC-80, MC-85 deluxe desk top microphones
- MC-48B 16-key DTMF, MC-43S UP/DOWN mobile hand microphones
- SW-200A/B SWR/power meters:
  SW-200A 1.8-150 MHz
  SW-200B 140-450 MHz
- SWT-1 2-m antenna tuner
- SWT-2 70-cm antenna tuner
- PG-2U DC power cable

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.

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NEW!

Ultimate Affordable HT!

TH-205AT

Affordable 5-watt hand-held transceiver. Ultimate Affordability!

It's here now! The affordable, "Kenwood Quality" hand-held transceiver. Standard features include a large, easy-to-read LCD display, wide-range power requirements (operates on 7.2 VDC—16 VDC), 3-channel memory, built-in battery saver circuit, and, when operated on 12 VDC, a robust five watts of power! The die-cast metal rear panel/heat sink assures cool, reliable operation. Receiver frequency coverage from 141—163 MHz is also standard—you can even listen to the "weather channels" at 162.40 or 162.55 MHz!

- Monitor switch—to check frequency when PL encode/decode switch is on.
- Extended frequency coverage for certain MARS and CAP operations.
- 3 memory channels store frequency and offset. And so easy to use! Simply press the memory channel number to recall your favorite channels!
- Night light, offset/reverse.
- 16-key DTMF pad for repeater autopatch is standard.

- NEW! Twist-Lok Positive-Connect™ battery case. A wide range of quick-change commercial duty battery packs are available.

- 12 VDC input terminal—allows direct mobile or external power supply operation. When 12 VDC is applied, power output increases to **5 watts!**
- Heavy-duty final amplifier and heat sink. The die-cast rear panel assures reliable operation. With the optional 12-volt PB-1 battery pack, the TH-205AT provides 5 W output. The standard 8.4 volt PB-2 provides 2.5 W output. (300 mW low power).
- Large, easy-to-read LCD display. Frequency, offset, memory channel, TX, RX, and battery indicator.
- Frequency UP/DOWN keys. Used to select frequency or scanning direction.
- Scan function key.
- Automatic battery saver circuit extends battery life. No buttons to push!
- Supplied accessories include: Rubber flex antenna, belt hook, 8.4 V, 500 mAH NiCd battery pack, wall charger.

Optional Accessories:

1) PB-1 12 V 800 mAH NiCd batt. pack (5 W output). **2)** PB-2 8.4 V 500 mAH NiCd batt. pack (2.5 W output). **3)** PB-3 7.2 V 800 mAH NiCd batt. pack (1.5 W output). **4)** PB-4 7.2 V 1600 mAH NiCd batt. pack (1.5 W output). **5)** BT-5 AA manganese/alkaline battery case. **6)** BC-7 Rapid charger for PB-1, 2, 3, or 4. **7)** BC-8 Compact battery charger **8)** SMC-30 Speaker microphone. **9)** SC-12, SC-13 Soft cases. **10)** RA-3, RA-5 Telescoping antennas. **11)** RA-8B StubbyDuk antenna • TSU-3 CTCSS encode/decode unit • VB-2530 2 m, 25 W RF power booster • LH-4, LH-5 Leather cases • MB-4 Mobile bracket • BH-5 Swivel mount • PG-2V DC cable • PG-3C Filtered cigar lighter cord.

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Jammin'

ACCORDING TO A STORY in *Sweden Calling DXers*, the Soviet Union has stopped jamming Russian-language broadcasts from China's **Radio Beijing**. Sino-Soviet relations have been warming up lately, and this seems an attempt to prove to the Chinese that the USSR is playing according to the rules. The Russians have also recently stopped jamming transmissions coming from Albania and South Korea. Although not considered a jamming transmitter, the Soviet over-the-horizon radar (affectionately known as the Woodpecker) continues to operate up and down the HF bands. It looks as though the U.S. will have as many as three OTHR systems running in the near future; government experts claim that interference to radio services in the 3–30-MHz range will be "minimal."

Video Nouveau

THE AMERICAN RADIO RELAY LEAGUE'S latest promotional video has begun production. The thirty-minute show, tentatively titled "The New World of Amateur Radio," depicts the fun and excitement to be found in ham radio, and targets both children and retirees. The production team includes **Forrest "Frosty" Oden N6ENV** and **Bill Pasternak WA6ITF**. **Roy Neal K6DUE** will be featured in the video. The producers are looking for interesting stories to include in "The New World"; if you have suggestions or material, or would like to volunteer a little time to the project, contact Bill Pasternak WA6ITF, 28197 Robin Avenue, Saugus CA 91350.

Lookithat!

SPEAKING OF THE LEAGUE, take a look at page 8 of this issue—you'll find an ad from the ARRL! Believe it or not, Wayne and the folks in Newington have decided that it's time to join forces for the sake of ham radio. We need to speak to the government with one strong voice to get the rules we want and to help save our hobby from sliding down the tubes. Yes, there's an ad for *73* in *QST*, too. Don't worry that Wayne has gone soft—if the ARRL screws up, you can bet that W2NSD will be right on top of it.

Decline

DESPITE THE SUCCESS of the volunteer testing program, the number of hams is still decreasing. The VECs certainly are packing them in, and testing sessions are being held as often as once every two weeks in some areas. But for several months in a row now, the number of hams deleted from the FCC computer has exceeded the number added. Granted, the totals are low—last month we saw a decline of only 70 licensees, but it's not the boom everyone had hoped for with the advent of the VE system. One of the biggest problems we have is that there is no way to count the number of operators in the country. It's only been a few years since the ten-year license was adopted, and a lot of our folks are just dying off. Most of the time the FCC is not notified of a licensee's death, so we end up with a lot of non-breathing people in the computer. Last month I mentioned that a mailing we sent out came back with 12% marked "deceased." *Twelve percent!* That rate is only going to climb as we head further into the ten-year license term. Unless Novice Enhancement works or we get a no-code license established, you can expect a sudden sharp decline in the amateur population when all of those ten-year licenses expire and there's no one alive to renew them.

PIARA

THE INTERNATIONAL COMMUNITY in and around Paris, France, has established the **Paris International Amateur Radio Association** to promote activity among licensed foreign operators in France. If you happen to be in Paris on the fourth Friday of the month, be sure to drop in on the regular club meeting (at 7 p.m.); the rest of us can get a copy of PIARA's newsletter by sending an SASE to Chuck Martin F/AB4Y, CPU A-316, APO NY 09777. Chuck reports that French reciprocal licenses are now being granted while-you-wait in Paris.

RFC

A NEW COMPANY has been formed by V/UHFers **Ken Holladay K6HCP** and **Everett Gracey WA6CBA**. Ken and Everett were the original co-founders of Mirage Communications. Their new company, RF Concepts, will offer products for the V/UHF enthusiast such as an all-mode, 170-Watt VHF amplifier with a built-in GaAsFET preamp and a 30-Watt HT amplifier also with a built-in preamp. You can get in touch with RFC by writing or calling RF Concepts, 2000 Humboldt Street, Reno NV 89509; (702)-827-0133.

This is Colleen Brady KB2BRL of East Aurora NY and her friend Lasagna. Colleen is 10 years old. We don't know how old the dog is.

Coop Clip

WE INADVERTENTLY snubbed Jim Cooper, Jr. KD0OZ when we published the results of *73*'s 160-Meter SSB Championship. Jim had over 500 QSOs and in excess of 100,000 points to capture the top spot in Minnesota and tenth place in the country. Good work, Jim!

G/ACK

REPORTING IN *GATEWAY*, the ARRL's packet newsletter, Jeff Ward G0/K8KA tells of a breakthrough for packet radio in Great Britain. The Radio Society of Great Britain was informed by the Department of Trade and Industry late in November that limited operation of packet stations would be allowed. Specially licensed packet repeater stations, running on 144.650 MHz, are able to store and forward messages, but are prohibited from acting as full-featured bulletin boards (English hams can't download files from the PBBSs). Right now, packet stations are restricted to two meters; late next year UHF allocations will be opened to packet operation. Jeff says that the network is using W0RLI autoforwarding software. Current PBBS-authorized stations are GB3AP, GB3BP, GB3DB, GB3DP, GB3EP, GB3HP, GB3HQ (RSGB HQ), GB3JP, GB3NP, and GB3UP (University of Surrey/UoSAT). If you want to keep up-to-date with packet in Great Britain, you can subscribe to *Connect International*, a new publication distributed by the RSGB. The price for airmail delivery is 9.24 Pounds Sterling; subscriptions run from July 1. Address your request to the Radio Society of Great Britain, Lambda House, Cranborn Road, Potters Bar, Herts. EN6 3JW, United Kingdom (love those English addresses!).

No Retest

THE FCC has decided that automatic retesting is not appropriate in most cases of trouble during a volunteer-administered ham exam. The commission reasoned that the team of volunteer examiners is close enough to the situation to decide whether an application should be processed or not. If someone is caught cheating, the exam papers will be flagged by the VE and no license will be issued. The applicant would be free to try again

at another testing session. The FCC did point out that they still have the authority to require a retest of any ham at any time.

Ham Scam

A VERY OFFICIAL-LOOKING LETTER from what appeared to be a government agency connected with the FCC was shown to us at the Ham West convention in Nevada. The gist of the letter was that the FCC would not renew a ham ticket unless you sent $50 to the license renewal service. The firm is based in Gettysburg, and the language used was very persuasive. Be aware that it does NOT cost anything to renew a ham ticket. Just get a Form 610 from your local ham club or Volunteer Exam Coordinator and mail it in. The license renewal services are in fact legal and usually service the broadcast and land mobile industry where paperwork is much more complicated. Someone apparently heard that hams were gullible.

Insta-Ham

KONRAD EKSTROM WB1GXM has asked the FCC to speed up the process of getting a ham license. Konrad suggests that the commission issue blocks of callsigns to the Volunteer Exam Coordinators, who would in turn issue calls at random to successful applicants. The FCC would still handle the printing and mailing of the official station and operator license. We'll let you know if Gettysburg assigns a number to Konrad's petition.

Vintage Heath

HEATH COMPANY President Bill Johnson recently presented two vintage Heathkit computers to the Smithsonian Institute in Washington DC. The H-8 microcomputer and H-9 terminal will be part of a permanent exhibit called "The Information Revolution." The presentation was held in conjunction with the Capitol Heath User's Group conference where nearly a thousand Heath computer owners gathered to exchange data about their machines.

Cap Tip

AN ERROR in Terry Staudt's "Defuse RFI" article in our November, 1986, issue may have left you wondering why you bothered with a coaxial ground. Please change the capacitors on the ends of the coax to .001 uF.

Classy Rigs

IF YOU HURRY, you can still dust off your vintage gear and have it running in time for this year's **Classic Radio Exchange**. The test will be held from 2100Z Sunday, February 1, to 0400Z Monday, February 2. A classic radio is considered to be any equipment at least ten years old, although you can enter the contest with any rig (you get more points by operating a classic radio). Exchange your name, RST, QTH, and receiver and transmitter model (if it's home-brew, just send the PA tube number). The same station may be worked with different equipment combinations on each band and mode. To calculate your score, multiply your total QSOs by the number of different receivers, transmitters, and states/provinces/countries on each band and mode. Multiply that number by your Classic Multiplier: the total years old of all of the receivers and transmitters you used (you have to make at least three QSOs on each piece of gear). If you have a classic transceiver, multiply its age by two. Certificates and memorabilia are awarded ("every now and then," says sponsor Jim Hanlon W8KGI) for the highest scores, the longest DX, the most exotic equipment, the best excuses, and so on. Send your logs, comments, and pictures to Jim Hanlon, 5560 Linworth Road, Columbus OH 43085. Be sure to include an SASE.

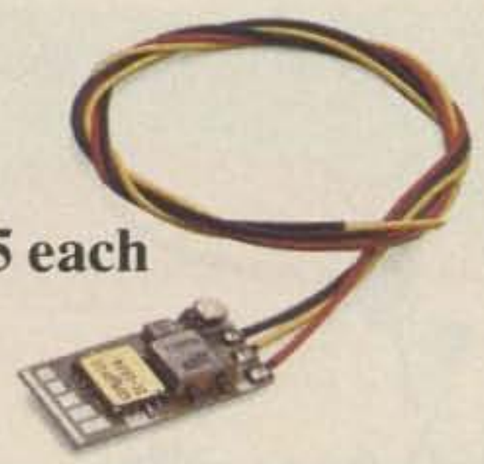
Aloha

THIS MONTH'S COLUMN comes to you with the help of *The W5YI Report, Gateway, Amateur Satellite Report,* and *Westlink*. Don't forget to send your news items to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: QRX.

The Nicest Things Come In Small Packages.

The SS-32HB is a new hybrid sub-audible encoder plucked from Communications Specialists' Hothouse. It has grown through a cross of the time tested SS-32, the subminiature SS-32M and space age micro circuitry. This programmable 32 tone encoder measures a scant .5 x 1.0 x .15 inches; no small wonder it allows the addition of continuous tone control to a bunch of hand held transceivers that lack space.

Why not snip your problems in the bud, with our fast, one day delivery and attractive one year warranty.



$29.95 each

NEVER SAY DIE

from page 4

of 48, which certainly seems much more equitable and logical.

Should we also recognize the class of license in some way? I've seen some suggestions that Novices and Techs have a one multiplier, Generals a two, and Advanced and Extras a five. Ten seems more reasonable for Advanced, but five is okay. I don't see anything wrong with that. Let's see, that would bring me up to 380 shares. Eminently reasonable, really.

Should there be a bit of extra credit for hams who have made substantial contributions to the hobby—for instance in the way of articles published in our major ham magazines? Several of the more perceptive hams have proposed this—suggesting an additional credit of two and a half shares for every page of writing which has been published. Sure, this would give an extra boost to regular columnists, but then these are the people who have helped make amateur radio exciting over the years, so perhaps it's time for them to get their reward. I like the concept, despite it's seeming to favor me slightly with my 1,437 pages of editorials and articles published over the last 30 years—which would only amount to an extra 3,620 shares, bringing me to 4,000 shares.

Let's see, where are we now? With 175,000 active hams with an average age of 56 years—with most licensed at about 16 years old, that would give them 40 years of hamming. Factoring in license class we have about 70,000 Novices and Techs, 97,000 Generals, and 274,000 Advanced and Extras. The additional shares attributable to being published would add 120,000 more shares. We'd need a computer to work all that out, but I figure I'd end up with around $295 million this way. Not personally being greedy, I don't see anything wrong with this. In fact, how's about checking out another ham band to sell? I know I might have a problem parting with 450 MHz for a personal gain of a lousy $300 million, but once they start talking real money, well... golly, these are things a person has to consider.

Sure, we've got a bunch of 450 repeaters around—most of 'em in Southern California. Maybe it's time to talk about moving them up to 1200 MHz, right? We should also remember that a major earthquake is due within the next thirty years which could slide Southern California right into the Pacific Ocean, resolving the 450-MHz repeater situation.

If the inactive hams have to pass up their share of the sale, there are likely to be some lively discussions over which of us have been "active" and which haven't. Perhaps we should work out the ground rules early on. My suggestion for proof of actual activity would be to ask for QSL cards showing postal dates. Too bad if you haven't been QSLing, which is a serious enough ham crime to warrant being declared a non-ham anyway. This might be a good time to note the *73* QSL card ad in this issue. Better safe than sorry.

All this is still slightly iffy, of course, but I've been around long enough to remember the great scandal in our past where a certain group of hams were reputed to have swapped off 7,300–8,000 kHz, which used to be part of our 40m ham band, in exchange for enough for them all to buy rather nice homes and upgrade their standard of living substantially. So perhaps there's a precedent for us to start cashing in on our assets.

FCC Chairman Mark Fowler has recently been talking seriously about leasing radio frequencies instead of just plain giving them away as the FCC has so far. That makes a lot of sense because radio frequencies are a natural resource just as much as land, minerals, trees, water, and air. So if the FCC starts leasing their radio frequencies, it seems logical for us to sell off some bands we haven't been using much—like some of our microwave bands which are both enormously valuable and are totally unused by us. Found money, even if it's only a few million dollars for each of us.

What is that rumbling sound? I think it sounds like lawyers rushing to buy *Callbook*s to find clients and get us to enter a class action suit to get the bonanza started. Heck, even if we did get $750 trillion for 450 MHz, by the time the lawyers got through we'd be lucky to get anything ourselves. Keep this whole thing quiet, okay? The best thing for you to do is tear this editorial out and burn it so no lawyers will find it by accident.

But doesn't it gall you just a bit to have the investment bankers and arbitragers happily scamming billions while we poor hams sit here almost penniless on top of what is obviously a gold mine?

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

VIVA GARLAND!

Back last summer when I gave a talk at the Dallas hamfest, I was approached by Ken McNatt N5EDI and asked to address the Garland Amateur Radio Club. Hmmm, with my tight schedule, working in an extra visit to the Dallas area wasn't easy. Well, I had to be in Las Vegas for Ham/West in early November, so why not stop off a day in Dallas for Garland?

The Garland club managed to round up around 250 hams to hear me—doing a good job of packing 'em into the Performing Arts Center. The visit came off just fine,

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with a nice dinner before my talk so I could get acquainted with the club movers and shakers—and the local FCC official.

Though the subject of my talk was serious, I tried to go at it with humor. Unless a lot of 'em lied, I think the group enjoyed the talk.

Getting on my dance card isn't easy—I'm pretty well planned out a year ahead—but I can often take off an extra day now and then and stop off on my way somewhere to give a talk—as I did in Garland. I'm planning on getting to the Miami, Orlando, Dayton, Atlanta, and Watertown SD hamfests, the Chicago, Las Vegas, Osaka, Seoul, Taipei, and Hong Kong consumer electronic shows, Comdex in Atlanta and Las Vegas, my submarine reunion in Mobile and a mini-reunion in New London CT, skiing in Aspen and Italy, and (hopefully) skin diving/hamming on Truk, Ponape, Majuro, and Palau. How much can I do in one year?

Anyway, if your club is near a major airport and on my way to or from somewhere I'm going, let's see if a date can be worked out. The cost? My expenses. Shep K2ORS says if I charge $1,000 I'll get a much more attentive audience. Well, I don't particularly need the thou—what I do need is to get more hams to find out how much fun *73* is to read these days. We need to do everything we can to get our hobby growing again.

W2NSD/5 puts on the feedbag with members of the Garland Amateur Radio Club (photo by K5HGL).

EXTRA-CLASS LICENSES—$100

An old ham friend of mine called with news that competition has driven the cost of getting an Extra-class license down to $100 in Puerto Rico. It seems they were going for $500 until fairly recently when competition reared its ugly head, forcing the price down.

Apparently the FCC is well aware of the scam and seems uninterested. While there's been some talk of doing this by mail order, at present it's still necessary to get down to Puerto Rico to get your license. It was suggested that *73* organize some Group License Tours. We could even include a visit to the famous dish at Arecibo. I'll bet we could put together a great package.

The really nice thing about all this, according to my informant, is that it completely bypasses all that silly Morse code and technical stuff. Hams entering the hobby via this route will be expected to learn their theory and regulations later. Pedro...ooops, I mean my friend...said there are a growing number of Extra-class hams on the air who haven't yet learned the Morse code for the letter E. That's terrible. By the way, it's "dit," so I don't leave you wondering.

The Puerto Rico VEC program solves a lot of the problems which have been holding back other groups. Not only have they eliminated the code requirement, the rules, and theory, but applicants don't even have to understand English! Before this, the ham exams had always been given in English, which was a problem in this Spanish-speaking country.

Admittedly, $100 is a bit more than the ARRL VECs charge, but look at the extra service you get! Even if I could pass the code, theory, and rules test cold, I'd prefer going to Puerto Rico, just so I wouldn't have to worry. Peace of mind is worth extra. No one fails their ham tests there.

But, you say, if the FCC knows about this, surely they'll insist on retests. Not according to the latest I've heard. Oh, there was some talk of it, but the FCC doesn't have the manpower or the money to do it. No, it's up to us to keep our own house clean—if anyone cares.

You might look at this another way—if you don't start rounding up your would-be ham friends and getting them on a special *73* magazine pre-ham tour to Puerto Rico, we're going to be up to here in Spanish-speaking Extra-class hams. Either get busy or start taking Spanish lessons.

Sure, I'm making light of a serious problem. What else can I do? The facts seem to be as I've stated, so what else can we do but laugh at the ridiculous position we've gotten ourselves into?

We lost the FCC's respect when we turned down their effort to get us to accept a no-code license for 220-MHz operation. That's when they pulled the plug on us, so now we're on our own. If we don't like VEC groups selling ham licenses to all comers, okay, what are we going to do about it?

In the early 1960s we had a huge influx of no-code, no-theory hams into the hobby. These were licenses given away by hams to their friends and wives. For a couple of years it was very difficult to find anyone on two meters who knew anything at all about theory. In time, these people either learned theory and code or dropped out.

I had an editor of *73* who came into the hobby that way—given his ticket by a friend. He knew zero about anything. Well, he got interested and later made an excellent editor.

So, though I'm not serious about running tours to KP4, in some ways it isn't all that bad an idea. If we could get a million new hams at $100 each and even 30% of them took to the hobby, we'd almost double our strength.

The average newcomer to amateur radio spends about $600 in his first year. $600 million in ham gear sales would sure perk up our dying ham industry.

HELP WANTED

Now that we've got *73* growing (for a change), I have one of the more exciting—at least for a real ham—career opportunities around. If you know a ham or two who might fit the bill, cue 'em in.

I'm looking for a ham who enjoys getting on the air with new ham gear, so we can test new equipment and report on it in *73*. I'm looking for a ham who won't be fazed by packet or OSCAR—perhaps someone who can help me set up stations on Caribbean islands for mini-DXpeditions.

Of course there are always special projects—perhaps setting up a bulletin board so any reader interested can call in and find out about contests, FCC actions, DXpeditions, OSCAR, and such. Or maybe we want to do something different and unusual for Dayton.

What I have in mind seems to me like the ultimate in a ham job. Of course it won't hurt being involved with a fast-growing publishing group. We've several more publications in the works, complete with staff investment opportunities to share in the equity.

New Hampshire isn't one of the fastest growing states by accident. The combination of quality of life and lowest taxes in the country has helped this growth. It's an exciting place to live.

In order to make *73* even more fun to read, I'm anxious for us to test virtually every new ham product coming on the market. I want you to know what will be fun for you (or what sucks). If you're like me, you're not as interested in an exhaustive technical evaluation as in a review of how the equipment is to use in actual practice. What are the benefits when compared to other gear? Things like that.

It seems as if every time three hams get together at least one of 'em has the entrepreneurial spirit, so the next thing you know they're talking about putting a new ham product on the market. They get themselves all excited and soon one of 'em is calling me to see what I think. My answer is simple—you're crazy. No sane person would get into the ham business—a dying market of fussy, crotchety, penny-pinching old men like me.

But if hams are resistant to common sense and want to get in the business anyway, I think we owe them the best we can offer in survival—which means giving them all the promotion of their products we can in *73*. We want to announce their new products—test 'em and report on 'em—and in general help let you know why they're so excited about what they're doing.

The few of us working on *73* are already up to here, so we don't have nearly enough time to review new products—hence this plea for help.

If you know someone who seems to fit the bill, pass the word. I know I'll find it difficult to understand why someone interest-

Or This Inexpensive

It Really Shouldn't Be This Easy

Remember just a few years ago, how it took a roomful of equipment just to work RTTY. And if you wanted more than one mode it took a dedicated computer system costing thousands of dollars. The new AEA Pakratts are proving it doesn't take lots of equipment or money to enjoy working all bands in five different modes.

First, A Good Idea

The idea behind the Pakratt is very simple. One controller that does Morse, Baudot, ASCII, AMTOR, and Packet, and works both HF and VHF bands. Of course the decoding, protocol, and signal processing software must be included in the unit, and connection to the computer and transceiver have to be easy. The unit also has to be small and require only 12 volts, so it will work both in the shack and on the road.

Second, Computer Compatible

It doesn't matter what kind of computer you have, we have a Pakratt for you. The PK-64 works with the popular Commodore 64 or 128, and the PK-232 works with any other computer or terminal that has an RS-232 serial port. The PK-64 doesn't require any additional programs. Simply connect to the computer and transceiver and you're on the air. The PK-232 needs a terminal or modem program for your computer. The one you're using with your telephone modem will work just fine.

PAKRATT™ Model PK-64

PAKRATT™ Model PK-232

Third, Performance and Features

The real measure of any data controller is what kind of on-air performance it gives. While the PK-64 and PK-232 use different types of modems, both give excellent performance on VHF. The optional HF modem of the PK-64 uses independent four-pole Chebyshev filters for both Mark and Space tones, and A.M. detection. The HF option can be factory or field installed.

The PK-232 uses an eight-pole bandpass filter followed by a limiter discriminator with automatic threshold correction. The internal modem automatically selects the filter parameters, CW Fc = 800 Hz, BW = 200 Hz; HF Fc = 2210 Hz, BW = 450 Hz; VHF Fc = 1700 Hz, BW = 2600 Hz.

The PK-64 uses on screen indicators to show status, mode, and DCD (Data Carrier Detect) while the PK-232 uses front panel indicators. Both units use discriminator style tuning for HF operation. And that's just the tip of the iceberg. Features like multiple connects on packet, hardware HDLC, CW speed tracking, and other standard AEA software features are included in both the PK-64 and PK-232.

Fourth, AEA Quality and Price

Not many manufacturers like to discuss quality and price at the same time. AEA thinks you want high quality and low price in any product you buy, so that's what you get with the Pakratts. Ask any friend who owns AEA gear about our quality. The people who buy our products are our best salespeople. As for price, the PK-64 costs $219.95, or $319.95 with the HF option. The PK-64A, an enhanced software unit with a longer flexible computer cable, costs $269.95 or $369.95 with the HF option. The PK-232 costs $319.95 with the HF modem included. All prices are Amateur Net and available from your favorite amateur radio dealer. For more information contact your local dealer or AEA.

Prices and specifications subject to change without notice or obligation.

↙65

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"When You Buy, Say 73"

ed enough in amateur radio to make a career isn't already reading *73*, but I'm game to try, if that's the case. Write to Wayne Green, WGE Center, Peterborough NH 03458, and explain clearly why I can't possibly get along without you.

VOICE VIA METEOR TRAILS

Amateurs pioneered the use of the ionized trails of meteors for communications, sending short bursts of CW to make contacts. It's a slow and difficult way to communicate, so it's never been popular.

A note from K2SE with an enclosure from *Defense Science and Electronics* magazine says that GTE has successfully sent voice via meteor trails. They did this by digitizing the voice—a sneaky way which we hams should have thought of. By digitizing the voice and sending the data at high speed in the second or less when a path is open, then turning the received signal back to analog, it's possible to get voice through the short, intermittent ionized trails.

Oh well, by being asleep at the switch we didn't get there first, but let's at least get there. Let's see what you experimenters can do with some two-meter meteor trail communications and digital voice. Who'll be first? I'm sure it'd be Sam Harris W1BU, if he were still with us.

AN EASY $100

A short piece in the October *Omni* struck a spark. It had to do with tuning in on computers from a distance—several hun- dred meters, the article said. Hmmm. That seems to have the making of a new type of business.

According to *Omni*, you need a TV set, a good directional antenna, and then a gadget for synchronizing the incoming data with the TV set's scan rate, which they say might cost about $15 to build.

We might do some experimenting to find better frequencies to monitor than the TV channels. If you knock together a synch unit which will allow you to display the received computer data on a TV set, you've got a great system for remote monitoring. However, if you were to park across the street from the Federal Reserve Board in a van with one of these, your motives might be suspected.

My suggestion for a new computer security business is to put together one of these and use it to demonstrate to businesses how vulnerable they are to spying. You should have no problem in getting a nice juicy contract to redo their computer cabling with shielded wire so they won't be broadcasting their secrets to anyone interested in tuning in.

I've got a $100 bonus for the best synch circuit submitted to me before March 1.

HAM/WEST

Though just in its second year, John Weaver W7IA's Ham/West convention in Las Vegas was, I believe, the biggest hamfest ever for the city. And that despite our having substantially fewer hams than we did fifteen years ago when Saroc was flying high.

Saroc got started mainly as a repeater-oriented gathering, with Art Housholder K9TRG bringing in suitcases of Motorola HTs, which he sold at incredibly low prices from his hospitality suite. Alas, Saroc eventually died of massive mismanagement.

While I'm not a big fan of Las Vegas, I do have to go there at least a couple times a year for business shows. The main ones are Comdex in November and the Winter Consumer Electronics Show in January. Yes, I enjoy the shows, but the "gambling" gets me. I put that in quotations because the odds are so stacked against you that there should be a more accurate word. Bleeding, perhaps. It's all around you, right from the slots as you get off your plane to slots in the grocery stores.

You have to have the willpower of an AA member to keep from dropping "just a couple" quarters in the ubiquitous slot machines. Like in the grocery, your change is red hot and begging to be put into the slots just a few feet away. Alas, once you put your first coin in a slot your fate is sealed. Doom. What follows is as inevitable as death eventually following birth.

The first two quarters go in easily. Big deal. 50¢, right? Well, unless you are out of quarters, there is no power on earth going to keep three or four more quarters from slipping right out of your pocket and into that bandit. You get oranges and plums, none matching. On the fifth quarter, you ring up cherries and two quarters plunk into the tin echo chamber for everyone in the casino (or grocery store) to hear. The machine is playing your song.

Can you pick up your two lousy quarters, take your 75¢ loss, and walk away? Legend has it that a woman actually did this in 1977. Plans are being made for a TV special to commemorate the event. You're 75¢ down and this damned machine is starting to pay off. As five more quarters go in, a sinking feeling starts—you're a couple dollars out to this crummy thief. Now you jam your quarters in with a grim determination to play until you hit the inevitable big one and get even again. After all, how long can it suck up your quarters without paying off? Ten dollars later you begin to develop some respect for the monster's appetite.

"Can you pick up your two lousy quarters, take your 75¢ loss, and walk away? Legend has it that a woman actually did this in 1977."

Hmmm, is it time to admit defeat and get the hell out of here? No, the next machine is sitting there and could well have been primed by the last sucker to dump a load—let's give it a couple of quarters and see. The whole miserable mess starts over.

There obviously has to be some reason to these things. I wonder, do the slots which are out front pay off better so they'll attract more players? Or are the back ones adjusted for a better payoff because fewer people will use them? We see the signs outside promising lavish payoffs from the slots, but we experience the usual sinking feeling and depression as the bandit gradually sucks us dry of our quarters and sends us home promising we'll never, ever, get caught in that net again.

The action is about the same at the craps table, only faster. You do, if you really know the game, have much better odds than with the slots. Indeed, I'm convinced that with some practice with a computerized crap game I'd be able to steadily win at craps. But it's a slow way to make money, so I haven't tried it.

Roulette has terrible odds, a sucker's game. Not as bad as Keno, but lousy. Vegas is paved from one end to the other with slot machines. With so many, and with so many people playing them, obviously they must be fun, right? I challenge you to find one slot player in the entire city who is smiling. After the first quarter it's a grim, losing effort to get back to zero. What you do is get down to zero.

Sure, there are some professionals who win regularly. But you'll see them at the craps tables and you'll see they know exactly what they are doing. They know the odds on every bet. I know you'll find this hard to believe, but the size of the betting area on the table is a good indication of the odds. The larger the betting area, the better the odds for the house. The very best bets for you aren't even on the table!

The pros bet the best odds they can and then watch how the dice are going. If they're running hot for a roller they bet with him. If they're running cold, they bet with the house. If there's no noticeable hot or cold trend, they come back later and see how things are running.

The head count for Ham/West was around 3,000 and everyone I talked with said they had a great time. The dealers who had brought ham gear to sell said they did best on Friday, before everyone had been viciously attacked by the slots and craps tables. Buying was much slower on Saturday. Well, I guess it's more "fun" to dump quarters into slots than go home with a packet radio unit, right?

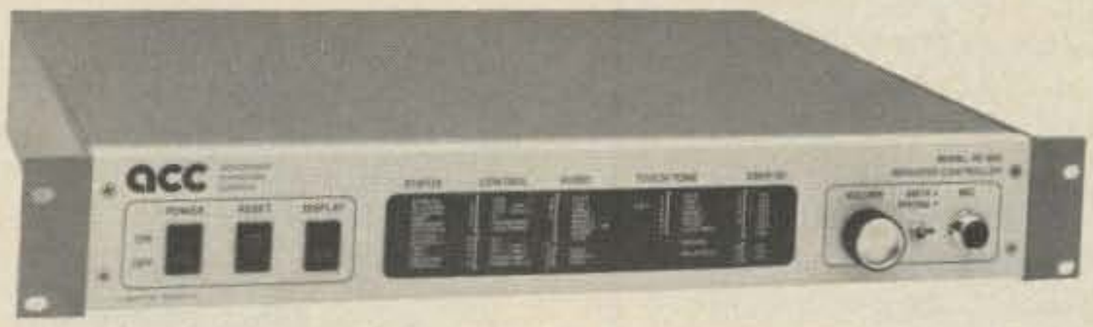
Ham/West will be coming at you again next November, so start saving your quarters. . . for some ham gear. The dealers will have great prices for you.

Comdex was just a day after Ham/West, with about 85,000 in attendance. It's the biggest computer show of the year, making hotel rooms very difficult to find. But next year, computer industry hams—and there are hundreds—might come a couple days early and take in Ham/West.

The Ham/West banquet came off well, with Roy Neal K6DUE officiating and Bill Pasternak

Continued on page 106

When we set out to make the best amateur radio equipment in the world, we had some pretty tough standards to live up to ...



... yours

... and ours.

So we designed the **RC-850 Repeater Controller**, the industry's top of the line repeater control system. Now in it's "third wave" of innovation, thanks to its designed for the future architecture and new software releases.
The '850 defines the industry standard in repeater control systems.

- Fully remotely programmable with Touch-Tone commands
- Front panel LED display
- Over 300 word customized male and female speech synthesis vocabulary
- Time/day of week Scheduler with 10 set-up states, 30 changeovers and events, over 100 scheduled items for hands off operation and automatic reminders.
- Full or half duplex autopatch, autodial (250 numbers), emergency autodial, reverse autopatch, antidialer, toll restrict including telephone exchange tables, supports remote and multiple phone lines
- Informative remotely programmable ID's (17), tail messages (13), bulletin boards (5)
- 16 channel voice response analog metering, automatic storage of min/max values on each channel, values may be read back on command or may be included in any programmable messages
- Supports synthesized remote base transceivers and full duplex links
- Individual user access codes to selectable features
- Mailbox for user-to-user, and system-to-user messages
- Paging – two-tone, 5/6 tone, DTMF, CTCSS, HSC display, user commandable and may be included in programmable messages (i.e. alarms)
- Easy hookup to any repeater

If your repeater budget can't afford the '850, we offer the **RC-85 Repeater Controller**, which we like to call the "second best repeater controller in the world". It's a scaled down, simplified version of our '850, but overall, it offers more capability and higher quality than anyone elses control equipment at any price.

- Remotely programmable with Touch-Tone commands
- Over 175 word customized male speech synthesis vocabulary
- Selectable "Macro sets" for easy control operator selection
- Autopatch, autodial (200) numbers, emergency autodial, reverse patch
- Remotely programmable informative ID's (7), tail messages (3), bulletin board (2)
- Supports synthesized remote base transceiver, control receiver, alarm
- Selectable, informative courtesy tones
- Talking S-meter, Two-tone paging
- Easy hookup to any repeater

For those who like to "roll their own", we can get you off to a rolling start with our **ITC-32 Intelligent Touch-Tone Control Board**. Much more than just a decoder, it's a mini-control system of its own, with the basic repeater and remote base functions built-in. And it can be tailored by you with its Personality Prom.

- 28 remotely controllable latched or pulsed logic outputs
- 4 alarm or remote sensed logic inputs
- Response messages to confirm command entry
- Repeater functions including COR, IDer, timers, courtesy tone, etc.
- Remote base functions including control of synthesized transceiver

Our new **Digital Voice Recorder** lets you remotely record ID's, tail messages, and various other response messages for automatic playback through your repeater. Audio is stored digitally with no-compromise reproduction quality in up to eight megabits of memory. The DVR can support up to three independent repeaters for a low per-channel cost. Its Touch-Tone activated voice mailbox lets your users easily record messages for other users when they aren't around.

- Remotely recordable, variable length audio tracks, accessed from controller messages
- Top quality, no compromise audio reproduction
- Supports up to three repeaters for cost effective installation
- Expandable to roughly 6 minutes of speech in 8 megabits of memory
- Easy interface to RC-850, RC-85 controllers, or to any stand-alone repeater

QST: Attention All Hams

If you own a shack, you should know about ShackMaster™.

ShackMaster lets you carry your home station with you in the palm of your hand. It acts as your gateway to the world, linking your handheld transceiver to your high performance HF station. Now, instead of your valuable home equipment being available to you 1% of the time, it's available 99% of the time! Whether around the house, in the yard, or across town, ShackMaster let's you take it with you.

But that's just part of ShackMaster's story. It lets you communicate with the family by handling third party traffic – its electronic mailbox and intercom let you keep in touch. And a simplex patch lets you place important calls directly through your home phone.

- Crossband linking – VHF/UHF to HF
- Telephone access to your home station
- BSR Home Control interface
- Electronic Mailbox
- ShackPatch™ intercom into the shack
- PersonalPatch™ simplex autopatch

All our products are documented with high quality, easy to read manuals. Our goal is to advance the state of the repeater art. But most of all, our products put the FUN back into the FUN MODE!

To order one of these advanced control products, call 408-727-3330. Technical manuals are available for purchase and the amount paid is applied as a deposit on the equipment. For specifications and a copy of our ACC Notes newsletter, just write or send in your QSL card to:

VISA MasterCard

Visa and Mastercard accepted.

acc advanced computer controls, inc.

2356 Walsh Ave • Santa Clara, CA 95051 • 408–727–3330

LETTERS

Number 18 on your Feedback card

SHELL SHOCK

I'm writing in response to your Never Say Die editorial of December, 1986. It is usually an informative and intelligent column, but what I don't understand is your desire to offend CBers with old, tired, recycled Polish jokes.

Half of your ranks started out as CBers, although most amateurs deny it, and if CBers didn't "upgrade" and get their Novice tickets, the Amateur Radio Service would never be able to increase its population.

Instead of trying to offend CBers, why not convince those old farts to honestly recruit new operators into the fold, instead of coming across with that old attitude of "I learned Morse code and if you want to become an amateur, so can you." Not everyone can master Morse code, it's as plain as that. And once you do, the only people you can communicate with are other amateurs. I suppose that's why most amateurs I know still have CBs in their cars. It's the only way they can talk to their XYLs at home, because Momma doesn't have her ticket.

Amateur radio operators and their leaders need to take a good look at their hobby and rewrite some of their rules if they want to bring some life and new blood back into their ranks.

I'm also amazed at KW1O's suggestion in the Letters column to Mad in Madison to pick a callsign and get on the air as a pirate—stating that it's no big deal and that he and Wayne started out in that fashion. What the hell is going on there? Can't you folks down at *73* get your acts together? Should a guy break his chops and go to classes and get his ticket or just pick out a callsign and start transmitting? How can one of your staff advocate such an idea? Perhaps I'm a bit naive, but that seems like a preposterous suggestion coming from a radio magazine whose purpose you say is to promote the hobby.

I think you and your staff were all sitting too close to the hull of that submarine when the shelling started and now you're suffering from group shell shock.

By the way, do you know why they call amateur operators "hams"? It's because they have the IQ of a pig's behind. Your column tells me something must be lacking in the average ham operator's mentality when you have to give them instruction on how to color in a map. I hope they can stay inside the lines!

Rick Chapter
Massapequa NY

Rick, anyone who reads your letter will understand my "desire to offend CBers."—Wayne.

Rick, it's not preposterous at all. Think about what I've been saying about ham radio for the past year or so: It's just a hobby. We're supposed to be having fun with amateur radio, but some folks get so bent out of shape trying to follow the "rules" that they lose sight of this simple fact.

I just talked to a fellow who's been a bootlegger for twelve years. He has WAS, WAC, and is going for DXCC. Is he having fun? You bet he is! The bootleggers are among the most active operators on the air.

Brief quiz: Who is smarter, the guy who spends a year trying to learn Morse code, fails his exam twice, and ends up with a Tech license when he really wants an Advanced, or the guy who just buys a TS-940 and operates wherever he pleases?

I don't advocate doing away with licensing, but neither do I begrudge the pirates their fun.—KW1O.

HAL IN HONOLULU

I read the "Thumbs Down" letter in your October issue—would have to agree with the author that he does indeed seem to be a dumb bastard—then read with great appreciation the December letter from "Mad in Madison." Great appreciation because he states so well the apparent state of mind of much of the non-ham community coveting the frequency allocations we have luxuriated in for so many years.

My appreciation is even greater when I realize that *he must be a ham*. Who else would "have friends I have been trying to talk into getting their ham ticket for years" and "have gone to many hamfests around the state"? Who but one of us could know us so well, dirty laundry and all?

Thanks, Mad in Madison, for hanging it all out there. Perhaps your letter will "rouse a little rabble" and get some of us thinking about the image we present to our fellow hams, possible future hams, and to the public.

Perry, you had to have his true identity before you would publish his letter. My bet is that he is a licensed ham, probably Extra class, and quite possibly a member of the *73* staff. Right?

Hal Sprague KH6GPI
Honolulu HI

"I think you and your staff were all sitting too close to the hull of that submarine when the shelling started."

Despite his letter sounding like an excerpt from Never Say Die, Mad in Madison is NOT, in fact, on staff here at 73. The letter was typical of a type we receive periodically which call for complete anarchy on the airwaves. Most of these folks are NRA types who haven't really thought much about what they're saying—they just mimic words that they have heard from other "activists."

Just as bad, though, are the hams who loudly and blindly cling to the current system just because they haven't the courage to think outside of it. Instead of just lashing out at new ideas, we have to consider questions such as, "What would ham radio be like if we had no FCC?" You may be surprised at the answer.—KW1O.

LIST

If we wonder why amateur radio is dying, enclosed is a partial list of those hobbies that do not require a license or exam: baseball, football, photography, computers, model railroading, scuba diving, stamp collecting, archery, bowling, jogging, video games, model cars, part-time jobs, tennis, etc., etc. Amateur radio requires study, outmoded code requirements, exams, and hoping that you pass. A kid of 12 or 13 does not want to be bothered with that. A hobby is to enjoy, not frustrate.

Ben Alabastro WA2PXR
Frankfort NY

Sorry, you didn't convince me. Everything that you mentioned in your list has entry requirements. Granted, you don't need a license to collect stamps, but you do have to spend a great deal of time learning about them. Sports require lots of practice if you want to become proficient at them. Ham radio is no different than anything on your list.

Part of the reason we're losing kids is that amateur radio is basically pretty boring. Years ago it was a great thrill to put together a little rig that would span the globe. These days all we do is drop a kilobuck on a pre-built do-all transceiver and plug it in. And it's not like hams are interesting to talk with, either. How many times can a 13-year-old hear, "Weather here is rain, rig here is . . ." before the radio is shut off permanently?

Thank goodness there are hams involved in pushing the edge of technology; in packet, digital television, satellites, signal processing, spread-spectrum, and so on. I think a friend of mine said it best when he stood up in a ham radio industry meeting and said, "We're just waiting for you old folks to die so that the young people can get on with this hobby."—KW1O.

ENTANGLED

Having gotten tangled up in the legally binding contract that NSD slithered into the lower corner of page 4 of the December, 1986, issue, I have searched the magazine advertisements from cover to cover to find the cheapest way out of this unscrupulous trap. My suggestion to others so entangled is to circle 142 on the Reader Service card and also buy some of your QSL cards. Hopefully the magazine will not stoop to such depths again. I shall endeavor to keep subsequent issues out of the hands of literate minors. And for the price of a 22¢ stamp, I will be one of the 17 people taking a gamble on the Feedback drawing.

Bradshaw B. Lupton, Jr. K1TE
Shrewsbury MA

NEW PRODUCTS

Number 21 on your Feedback card

The model 5000 Phone Remote from Tri-H Communications.

PHONE REMOTE

Tri-H Communications now offers the Phone Remote model 5000A, a product that allows operation of an HF, VHF, or UHF base station from any touchtone™ telephone. The model 5000A requires no internal connections to the transceiver and includes a security code. Programmable activity and push-to-talk timers with time-out warning beeps are provided in case the telephone connection is lost.

For complete information, check Reader Service number 216.

BIRD MODEL 4421

Bird Electronic Corporation has introduced the model 4421 rf power meter, a programmable, microprocessor-based instrument that measures forward and reverse power to 1 kW from 1.8 MHz to 1 GHz. The unit features an accuracy of ±3%. Two sensors cover the frequency range; each sensor carries a calibration profile in a reprogrammable memory. An optional interface provides for remote operation from a GPIB- or RS-232-equipped computer.

For more information about the model 4421, check Reader Service number 214.

Bird's model 4421 rf power meter.

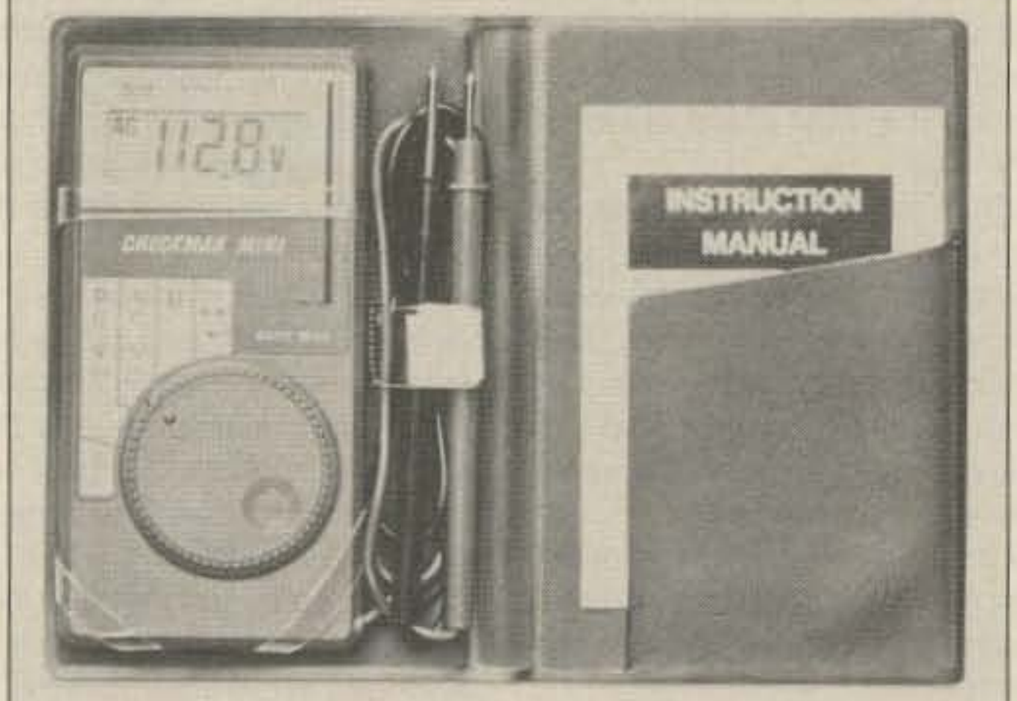
SUPERSCAF

Aftronics, Inc., has announced SuperSCAF, a digitally tuned switched-capacitor audio filter for CW, SSB, RTTY, and other narrowband modes. The unit incorporates a crystal-controlled 14th-order elliptical bandpass filter whose upper and lower cutoff frequencies are programmed via a front-panel thumbwheel switch. Cutoff points may be selected from 300–3,500 Hz in 100-Hz steps. The initial skirt slope is 150 dB per octave with an overall stop band attenuation of at least 51 dB. Passband ripple is less than 0.2 dB.

SuperSCAF is available for $137 in kit form; please check Reader Service number 215 for more details.

NEW PRODUCT OF THE MONTH

This little gem caught our eye:



TESTON'S CHECKMAN MINI

Teston's card-size Checkman Mini fits in your shirt pocket and gives immediate voltage and resistance measurements with built-in autoranging. The unit can handle up to 20 megohms and 500 V ac or dc, displaying the value on a 10mm-high LCD. The Checkman Mini also features an audible continuity checker and diode tester.

The Checkman Mini retails for $35; for complete information, please check Reader Service number 217.

New communications analyzer from Ramsey.

RAMSEY COM-3

Ramsey Electronics has introduced the COM-3 programmable microprocessor-based communications service monitor. The COM-3 covers 100 kHz to 1 GHz in 1-kHz steps and features keyboard entry of parameters, programmable memory, high sensitivity in receive mode, full transmit protection, a built-in frequency counter, and an LED bar-graph deviation indicator.

The COM-3 runs on a built-in rechargeable battery and weighs less than 10 pounds, making it ideal for portable use. Suggested list price is $1,995; for further information, please check Reader Service number 205.

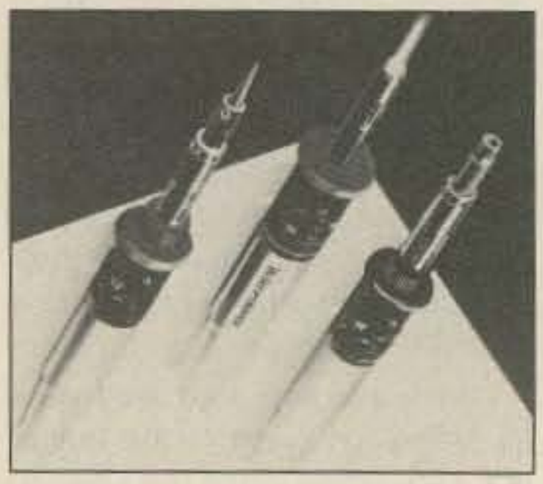
220 TRANSVERTER

Microwave Modules of Liverpool, England, has announced the MMT 220-28 15-Watt linear transverter for 220–225 MHz. The unit connects directly to the transverter jack on your transceiver and features a MOSFET front end for excellent receive performance. Transmit mixer sensitivity for full output is 1 mW.

The MMT 220-28 retails for $250; for more information, check Reader Service number 208.

WELLER PYROPEN

The new Pyropen from Weller® is a versatile, LP-gas catalytic soldering iron, torch, and hot-air gun. The handle stores enough gas for about three hours of operation and takes only a few seconds to refill. A control lever regulates the gas volume and



Weller's Pyropen gas-powered soldering iron.

Davle Tech's rechargeable power screwdriver.

adjusts the temperature for soldering. Temperature control ranges from 392° to 932° F. A number of tips are available, including a power chisel, a tapered needle, a micro spade, and a tapered pyramid.

Reader Service number 210.

RECHARGEABLE SCREWDRIVER

Davle Tech, Inc., now offers a powerful multipurpose screwdriver which runs on rechargeable NiCd batteries. The tool features an LED battery indicator, a forward/reverse switch, a detachable pistol grip, and four driver bits.

Reader Service number 206.

JENSEN STRIPPER

Jensen tools has introduced a thermal wire stripper designed to remove thermoplastic insulation from 14–30 AWG wire. The specially shaped nichrome element heats to 450° F in less than five seconds, and Jensen claims that, due to the minimal mass of the element, it will not burn you if you touch it during use.

For more information about Jensen's thermal stripper or for a free catalog of Jensen tools, check Reader Service number 211.

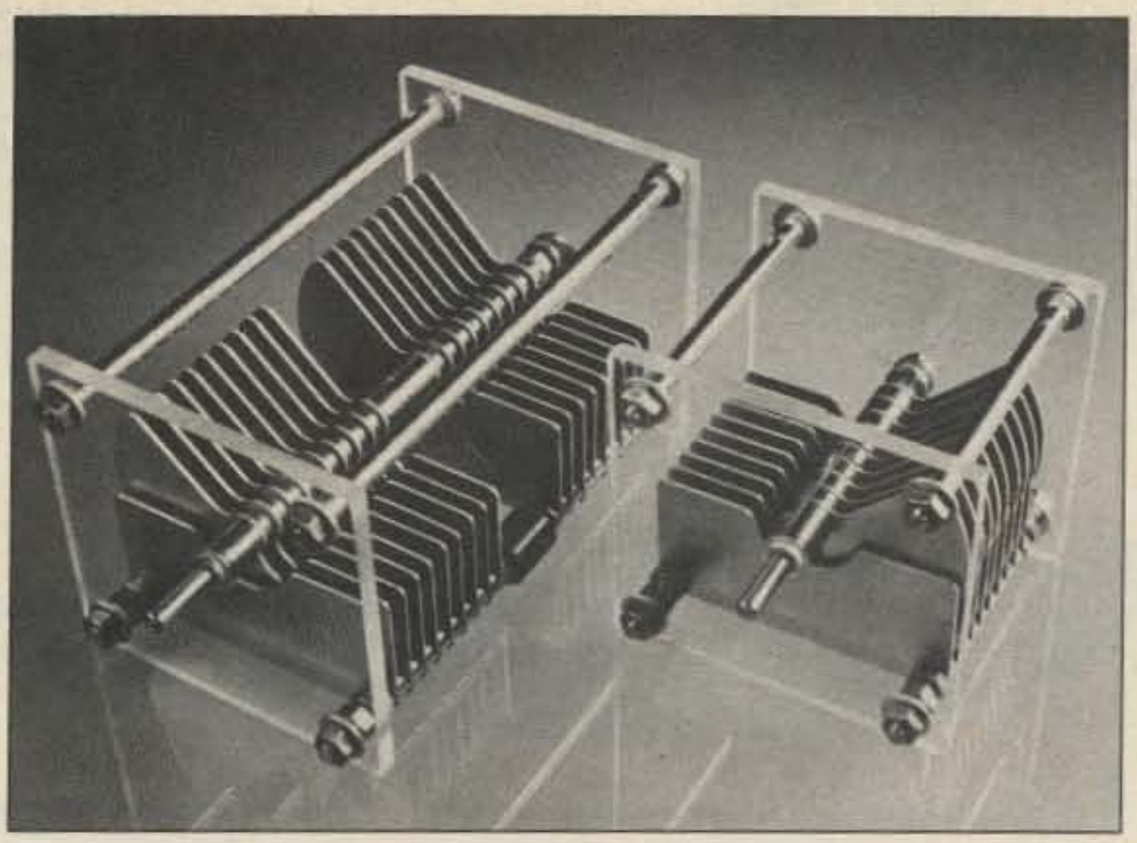
IRI FILTERS

International Radio, Inc., has added a number of 6- and 8-pole filters to their line of products. The new filters cover the ICOM 730, 735, 740, 745, 751, R70, R71A, 271, 471, and 1271, and Kenwood's 930, 940, 830, and R-2000. Also available from IRI is a CW switch kit for the TS-940/930/830, which yields a new 250-Hz CW position.

For more information on IRI filters, check Reader Service number 212.

NEVADA CAPS

Nevada Communications of Portsmouth, England, has announced two high-power variable capacitors for amateur use. The TC-250 is a 13–250-pF capacitor and the TC-500 gangs two sections together for up to 500 pF; both models have a breakdown voltage of 7.8 kV and a plate air gap of 2 mm.



Nevada Communications' variable capacitor kits.

The capacitors are approximately $30 and $40 for the TC-250 and the TC-500, and both are available at a lower price in kit form. For complete details, please check Reader Service number 213.

CB ON-GLASS

A new On-Glass® CB antenna designed to look like a cellular telephone installation is available from The Antenna Specialists. The model M-906 uses a no-holes mount which couples rf through the windshield. The black whip is protected from the elements with Duracoat™, a highly resilient material resistant to abrasion and extreme environments.

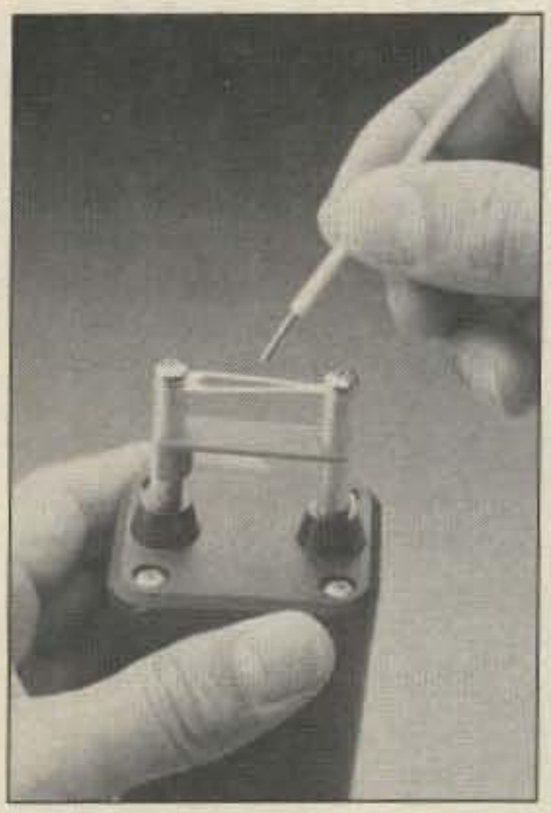
For further information, check Reader Service number 207.

PCB DESIGN

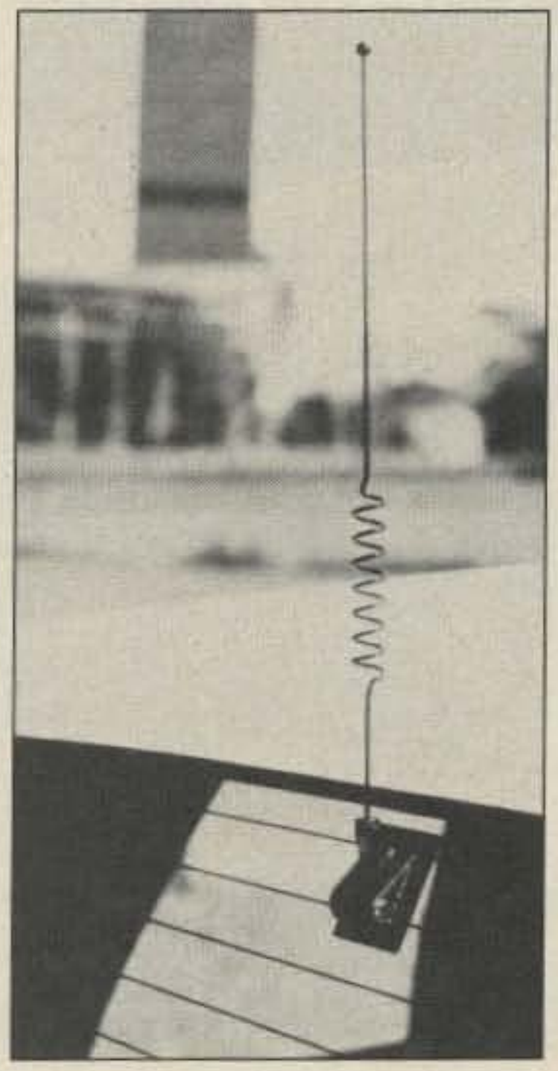
Project:PCB is the name of new CAD software offered by DASOFT Design Systems. The package assists in the design of multilayer printed circuit boards with schematic capture, automatic routing, and board layout (a plot routine generates camera-ready art).

After a schematic is entered using the mouse-driven editor, pin connections are defined. Next, the board itself is designed by defining the size and shape of the substrate, location and size of cutouts, and the footprint and placement of parts. A library of standard parts is available, or you can build your own. The routing algorithm then takes over and lays out the traces. Finally, the plot section generates proof copies with problem areas marked, or camera-ready artwork.

Project:PCB requires an IBM XT, AT, or compatible with 640K RAM and at least 10 megabytes of hard-disk storage. List price is $950; check Reader Service number 209.



Thermal wire stripper from Jensen tools.



New On-Glass CB antenna from Antenna Specialists.

73 Review

ICOM IC-120

1.2-GHz Mobile FM Transceiver

by Peter H. Putman KT2B

ICOM America, Inc.
2380-116th Avenue NE
Bellevue WA 98004
Price class: $580

Number 29 on your Feedback card

ICOM of America has been making great strides toward a full product line of UHF radio equipment in recent years. Along with their IC-1271A (reviewed in September, 1986), ICOM also offers the IC-120, a mobile, 1-Watt, synthesized transceiver for the 1260–1300-MHz range.

I received the 120 and the 1271A for review at the same time, and I intended to run some tests using both in the low-power mode. My plan was thwarted by a blown front end in the 120, so an alternate setup was arranged for the replacement 120.

Features

The 120 is about the same size as ICOM's popular IC-27A/37A/47A series FM radios, although it uses a different bracket. Frequencies are selected by two vfo's in 10- or 20-kHz steps, with six memory channels incorporated. The transmitter is rated at 1 W output power across 50 Ohms, drawing 2.0 Amps while doing so. The receiver is rated at less than .3 uV for 12-dB Sinad, and the squelch sensitivity is in the range of .25 uV.

As far as actual operation goes, it's easy to set the controls and program the memories. The frequency offset is programmable, which is a good thing since the Japanese seem to have one standard and we in the U.S. another! As you can imagine from running 1 Watt output, there's no low-power switch. Other controls allow you to step up and down in 1-MHz increments, which is about as fast as stepping up and down in 100-kHz increments on a 144-MHz radio. . . SLOW. Don't forget, we're trying to cover 40 MHz of bandwidth here—more bandwidth than 50, 144, 220, and 430 MHz put together!

ICOM employs a type N connector as on the 1271A. Another rear-panel connector is designated "Accessory Socket" and allows remote T-R keying of the 120, supplies remote 13.8 V dc, and allows for a discriminator meter connection. Incidentally, the remote keying connection would be very useful for a 1260-MHz remote base link or repeater link. An external speaker jack is provided as well.

An unusual feature is the RIT control. You don't see these on FM transceivers on lower frequencies, but any synthesizer error of, say, 1% at 144 MHz quickly becomes 9% up here. Therefore, someone transmitting on what he thought was 1260.00 MHz could actually be as low as 1236.97 MHz or as high as 1283 MHz! Fortunately, ICOM rates the frequency stability within .0005%—which is still off by 6.3 kHz; hence the need for the RIT. In this case, the RIT still covers +5 kHz, so it should do the trick.

The standard offset provided is ±10 MHz. You can scan the six memories or between any two frequencies programmed into memories 1 and 2. Scanning speed is adjustable through the top cover, as is the scan pause interval, stopping on a busy channel, and CPU reset.

Test Equipment

Not having any accurate test equipment to verify claims (at least as far as receiver sensitivity goes), I decided the best way to find out about the receiver was in a mobile situation. Two Larsen Electronics collinear antennas for 1300 MHz were obtained courtesy of the factory for this test, and I installed the 120 in my Honda with the antenna fed by 17 feet of low-loss Belden 9311 RG-58/U. Its loss at 1300 MHz is rated at 16 dB per 100 feet. Incidentally, the Larsen antennas use a special mount—type MM-NMO—and will definitely not work with the more conventional LMO series mounts.

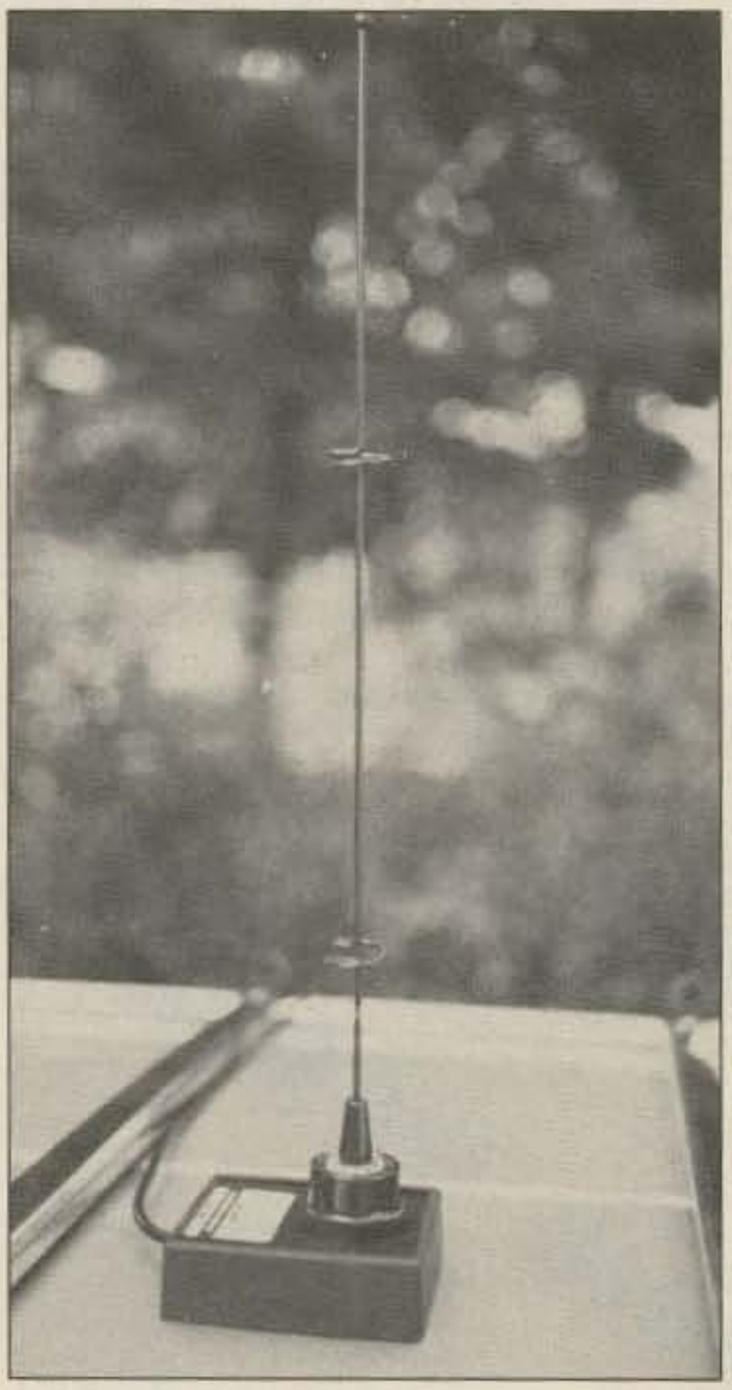


Photo A. The Larsen 1300-MHz collinear antenna with NMO magnetic mount in position on the Honda's roof.

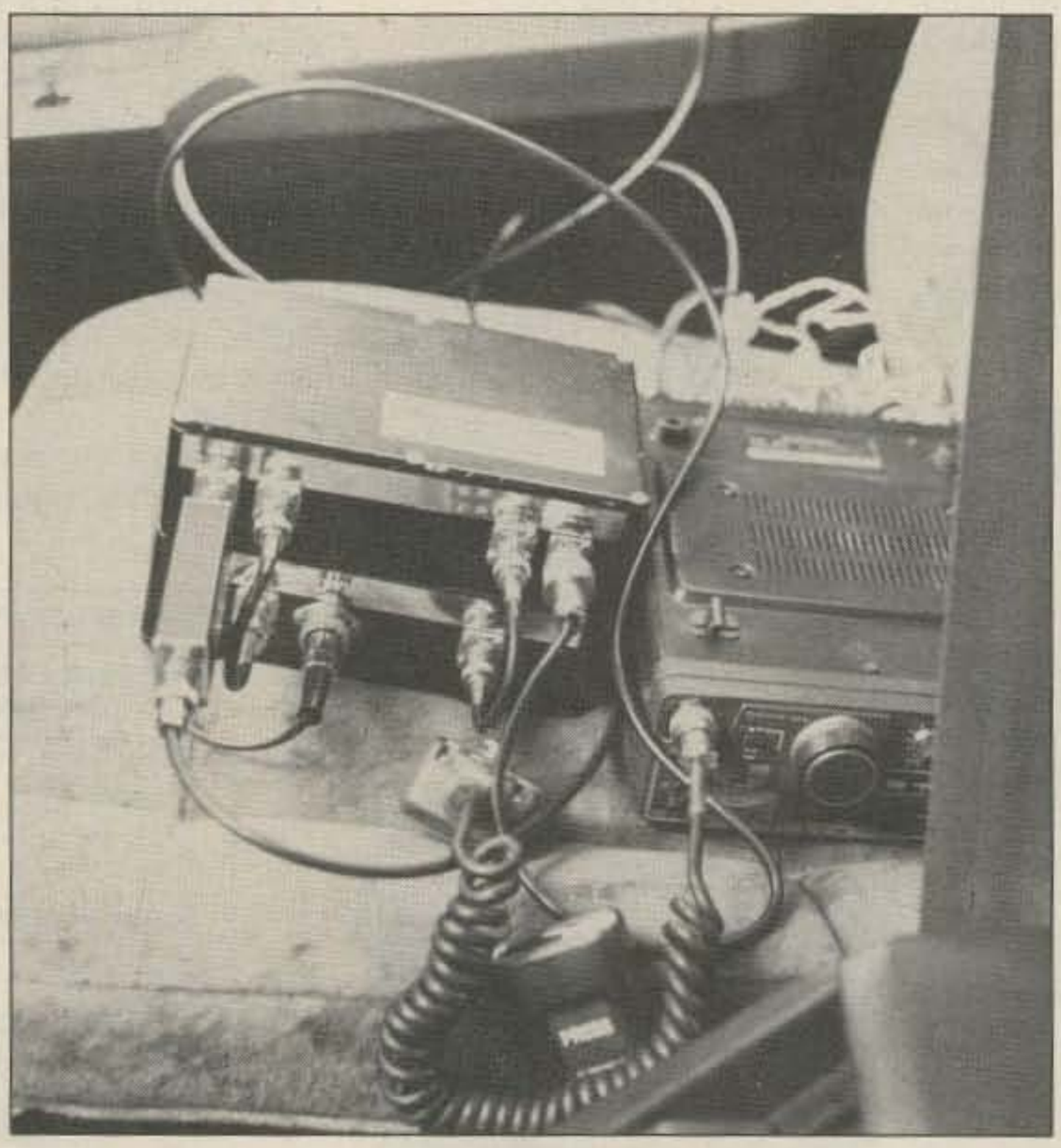


Photo B. The companion setup on 1296-MHz FM—an MMT-1296/144 and TR-9000 exciter. A Larsen antenna was also used here.

Photo A shows the Larsen 1300-MHz antenna atop the Honda. For purposes of this test, I again enlisted the services of Steve Katz WB2WIK who agreed to put the hodgepodge of stuff shown in Photo B into his Toyota. It's actually my trusty Kenwood TR-9000 with a Microwave Modules MMT-1296/144 and appropriate connecting cables. This setup runs about 1.5 Watts output, on par with the 2+ Watts I measured from the 120 with the Bird 43 and the 5-W, 400–1,000-MHz slug.

Test Results

To say the range is limited when running low-power levels at

1296.200 MHz (our test frequency) is an understatement! At one point, Steve and I were no more than a quarter mile apart, yet I couldn't copy him at all due to foliage attenuation. Steve positioned himself atop one of the higher spots around here on a ridge with good views in all directions, while I drove up and down smaller hills nearby.

Results were as I expected: full-quieting copy when line of sight was less than about one mile, and driving behind ridges within a half mile resulted in complete loss of signal. Audio reports were excellent. Incidentally, the 120 uses a 3SK48 in the front end, which I believe is a low-noise MOSFET (also used in ICOM's 430-MHz gear). This radio would benefit from a preamp if running the outboard 10-Watt accessory amplifier, model ML-12.

The results obtained from the driving tests indicate that you probably would need the 10-Watt amplifier most of the time, especially if trying to access a repeater. In hilly areas, such as here in northern New Jersey, it would be all but impossible to work a repeater unless you were within line of sight of it. Based on these observations, stations living in relatively flat areas, such as the Midwest and Southwest, using repeaters on tall structures with long horizon sightlines, will get the most out of the 120. Out here, it's all but useless except for local area net operation and possibly point-to-point links.

Conclusion

This radio is not for everyone. I couldn't think of any particular use to put it to except for low-power point-to-point links or as a remote base link. I think it would be very popular in a city environment where a wide-coverage machine was line-of-sight to most of the users. The apartment dweller restricted by antenna size could have a ball with a small 1260-MHz yagi on a balcony for simplex or repeater work. And, of course, it would be ideal for point-to-point packet communications where privacy was desired.

Remember that turning the average 1296 yagi 90 degrees away from you puts the signal down over 80 dB, and you have the possibility of co-channel operation. One station could be horizontally polarized and the other vertically polarized! Could this be a solution to FM channel congestion? Those who have the right setup might wish to try it with the 120. Now if ICOM would just come out with a multimode version of this radio.■

Mirage/KLM 1.2–44 LBX

44-element 1.2-GHz Yagi

by Peter H. Putman KT2B

Mirage/KLM
PO Box 1000
Morgan Hill CA 95037
Price class: $154

Number 30 on your Feedback card

With the expansion of major equipment manufacturers (such as ICOM, Kenwood, Microwave Modules, and SSB Electronics) into the 23-cm band, it was only a matter of time before we started to see new antennas for this band. Some have been around for a while (F9FT 23-element yagi, Jaybeam, Down East Microwave loop yagi), while others are relative newcomers (F9FT 55-element long boom and KLM 1.2–44 LBX).

Readers will remember that the F9FT 55-element yagi was reviewed back in April, 1986. Using a formula derived by engineers at MIT, the measured gain was found to be within .25 dB of the claimed gain. I obtained a pair of the KLM 1.2–44s to make that very same measurement—but I'm getting ahead of myself!

The KLM 1.2–44 LBX comes essentially complete from the box. You need only push the two boom sections together and attach the horizontal boom brace and mast mount, as well as the pre-assembled and tuned driven-element/reflector section. Assembly time from opening the box is about 20 minutes and requires only a screwdriver and 11/32 and 5/16 nutdrivers. The two boom sections are joined where one of the elements passes through the boom, and the element insulating collar keeps it secure. Photo A shows the completed beam.

The horizontal boom brace runs underneath the antenna boom. The brace is attached to the boom using clamshell-type assemblies. The boom brace is what gets bolted to the main mast, since most masting is such a significant portion of a wavelength at 23 cm that it would severely de-tune any element it was behind or in front of.

The driven element/reflector is clever. It consists of a hardline balun and stiff-wire driven element (folded-dipole design) encased in a hard plastic. Also encased is the rear end of the type N connector, and fitted over it and secured with a nut and lockwasher is the screen-type reflector. A secondary strap from the screen to the boom makes the ground connection for rf. See Photo B for a close view.

The entire assembly is fit snugly into the rearward section of the boom (identified by the screw hole for the reflector ground) and secured with the first director. Very strong! In fact, the whole antenna is built like a tank! Compare it to the plastic-supported elements on the F9FT or a standard loop yagi and you'll see that with the 1/4"-diameter aluminum rod elements, it would be pretty hard to break anything on this beam.

Speaking of which, this design is unconventional because the elements do go through the boom as opposed to being supported above it. Does it de-tune the design? Not at all, as KLM claims 18.2-dBd gain for the 1.2–44 LBX. In my tests, I set out to verify these claims. The test range was two masts 10 feet high, 70 feet apart (100 wavelengths at 23 cm).

One problem I was going to have was the accuracy of my rf millivoltmeter at 23 cm, since the rf head was only accurate to 600 MHz. Some calibration tests were performed using the IC-120 as a signal source. It developed 2.6 Watts into a 50-Ohm dummy load, as measured with a Bird 43 and 5-W slug. These measurements were verified on a 25k slug (25 W, 1.1–1.8 GHz). Then, the rf millivoltmeter was driven through pads known to be good at

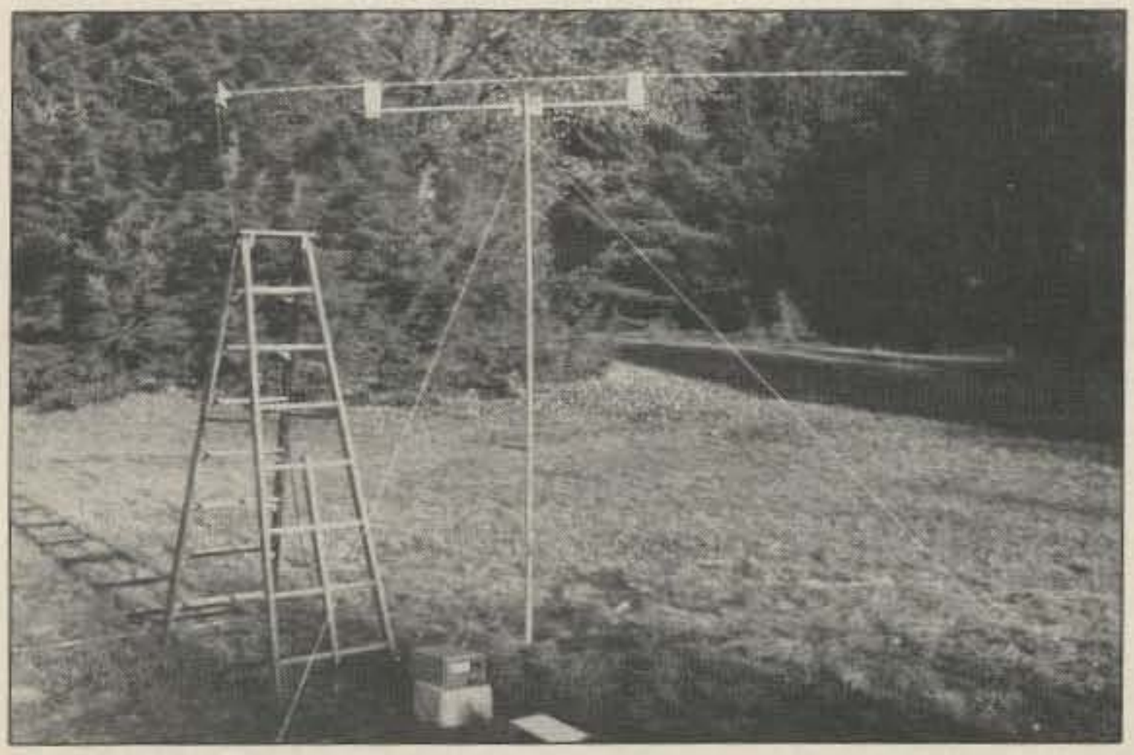


Photo A. The completed 1.2–44 LBX in position and ready to test. Note the unusual boom brace.

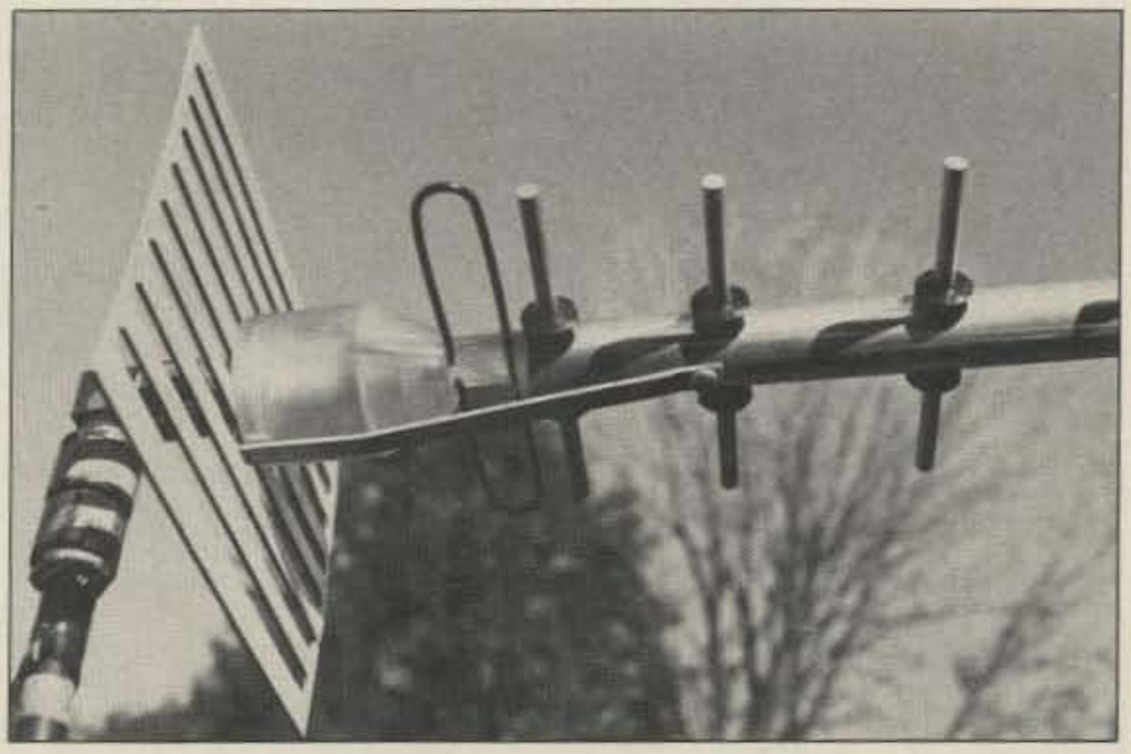


Photo B. The driven element and reflector assembly up close. The balun is made from miniature hardline.

1300 MHz to arrive at the final figure that read 10.5 dB high at 1296.00 MHz.

The next step was to set up the IC-120 with another Bird 43 and the feedline to determine its loss. This was calculated to be about 1.5 dB (it was a little more than 13 feet of 8214 RG-8/U) and was verified with two Birds and a dummy load. Locking the IC-120 on with a constant power source, I then rotated the companion 1.2–44 LBX for maximum signal. The reading was +12.5 dBm. Subtract 10.5 dBm from the correction factor, and you have a reading of +2 dBm, or 1.75 mW.

If you use the formula in Fig. 1, dividing Pr by Pt (.00175/2) results in a figure of .000875, or 8.75 x 10^{-4}. Next, use the left-hand side of the formula as follows: R = 99.39 wavelengths (70 feet) and λ = .231 (23.1 centimeters @ 1296.100 MHz). Putting these numbers into the formula $4\pi R/\lambda$ results in the value 5,406.65. The square root of .000875 is .0295, and .0295 x 5406.65 = 159.93. This numerical expression of gain is for two yagis, so divide that value by two: 159.93/2 = 79.96.

Now, calculate 10 log10 of 79.96, and the answer is . . . 19.02 dB. Therefore, one of the two 1.2–44 LBX yagis exhibited 19.02-dB gain in the test setup. This certainly is close to what KLM claims at 18.2 dB, and in fact theirs may be a conservative rating.

$$G^2 = (4\pi R/\lambda)^2 \, Pr/Pt \text{ or } G = (4\pi R/\lambda)(\sqrt{Pr}/Pt)$$

G = Gain expressed arithmetically (not in dB).
λ = Free space wavelength in units.
R = Range of separation of antennas in same units (λ).

Fig. 1. Formula for calculating gain of either of two identical yagis.

While no data was available on polar plots, I would suspect that the KLM is not quite as sharp as the F9FT 55 element. I'll try to update this data through actual use in the coming months. By the way, input vswr was on the order of about 1.4:1, whereas KLM claims better than 1.5:1—again, a conservative rating.

Conclusion

The KLM 1.2–44 LBX is a sturdy, well-designed antenna for the 1260–1300-MHz band and exhibits plenty of gain. It is lightweight (less than 10 pounds) and good for portable operation as well, owing to its rugged construction and easy assembly (or disassembly). The rigid, large-diameter boom also aids against sagging and element misalignment. Reader Service number 201.■

Telex/Hy-Gain OSCAR Antenna System

Telex Communications, Inc.
9600 Aldrich Ave. So.
Minneapolis MN 55420
Price class: $365

by Jim Godron N1EJF

Number 31 on your Feedback card

The Telex/Hy-Gain OSCAR antenna system represents a good choice for anyone considering satellite work in a serious way. The setup (model number 218S) consists of a 30-element 435-MHz antenna on a 134″ (4.2-wavelength) boom, a 16-element 2m antenna on a 168-3/4″ (2.1-wavelength) boom, and a hollow five-foot fiberglass cross boom. Everything is shipped via UPS in a single box.

The 435-MHz antenna consists of two boom sections that are held together at the point where the antenna mounts to the cross boom. The sections fit into a sleeve that is compressed by the mounting assembly. This arrangement appears to be quite secure, and I anticipate no problems from it in the future.

There is a small (12″) section that is a coax support bolted in place at the rear of the boom. On the unit that I received, the coax support was not drilled. It was a fairly simple matter to drill the support, but I was surprised, given the overall quality of the antenna, that this was required. I brought this to the attention of the factory, and when they checked the rest of their stock, no other units were found to have this problem.

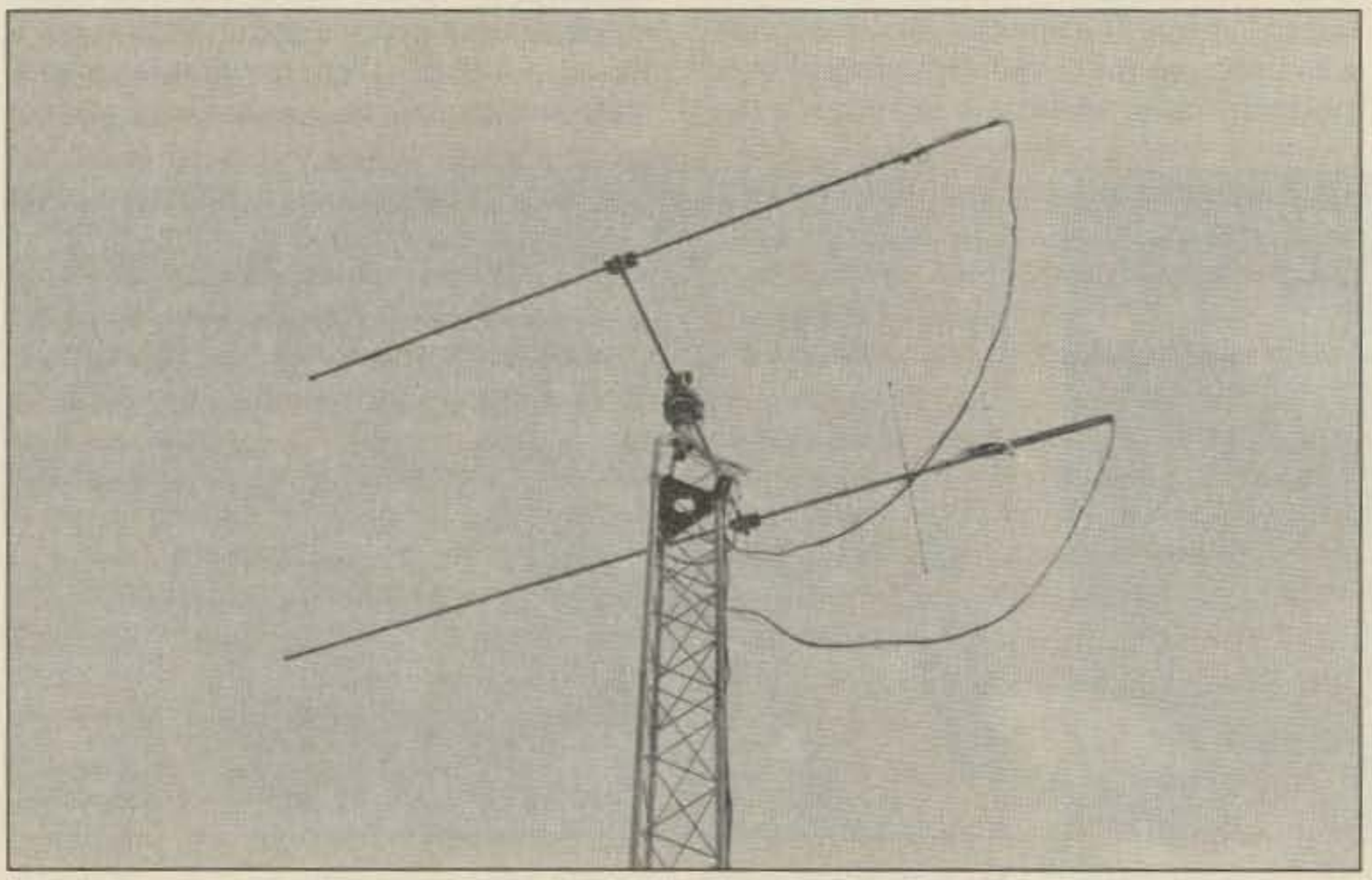


Photo A. Telex/Hy-Gain's OSCAR antenna system.

The 2-meter antenna consists of three boom sections. The front section fits inside the center section and is bolted in place. The rear and center sections are joined by an internal sleeve. The boom is held to the mast by the same type of clamp used on the 70-cm antenna.

The elements on both antennas are precisely cut and color coded. They fit through two insulators and are held in place by stainless-steel slip nuts. Measurements are given to 1/32″. I suggest that you triple-check each measurement to maintain that 1/32″ standard, as the measurement of the exposed sections of the elements must be EXACT.

The 70-cm antenna uses a delta match and the 2m antenna uses T-matched driven elements. These high-efficiency designs are easy to assemble, but I noticed on both antennas that when exact measurements were observed, the encapsulated feedpoints were too narrow by about 1/4″. If the error were absorbed by each side of the driven element equally, the feedpoints could be off by as much as 1/16″. I think it's important to point out that I have noticed no operational problems because of this.

In addition to the SO-239 (on the 2m antenna) and the N connector (on the 70-cm antenna), there are also two wires coming from the coax harness. These wires are attached internally to switching relays. The relays are rated at 200 Watts and allow you to select either right- or left-hand circular polarization with the application of 9 to 15 V dc. The Kenpro rotator that I'm using requires six conductors for each rotator (azimuth and elevation). By using 8-conductor rotor cable, I can easily use this most interesting feature.

The manufacturer suggests that you allow at least four hours for assembly of each antenna. While it didn't take me nearly that long, I do think it's a good idea to work in an unhurried manner.

I assembled the antennas over several evenings in the basement, so it didn't present much of a problem when the 2m antenna

turned out to be missing some hardware. I phoned Telex and had the parts the next day. I had a very interesting conversation with Telex about their quality control process, and I'm convinced that the several very small problems that I had are the result of my getting the first antenna off the line.

The installation of the system went fairly easily. We put the antennas and rotator together and then hoisted the whole thing to the top of a 40-foot tower. The antenna required this height in order to clear the trees, and I was a little concerned about the long run of transmission line.

Joel Knoblock of RF Connection came up with the solution in the form of International 9086 cable. This is the imported version of 9913, and Joel tells me that the specs may be a little better. In operation, the 9086 seems to be doing the job, and I am no longer concerned about the losses.

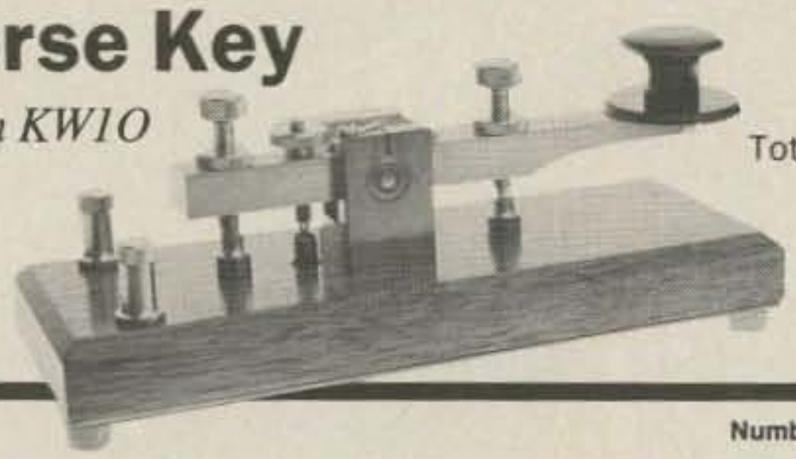
ICOM very kindly provided me the use of IC-271H and IC-471H transceivers, with power supply and mast-mounted preamps for 2m and 70 cm. These full-featured state-of-the-art rigs have allowed me to fully experiment with the antenna array, and I have been nothing short of delighted with the results. In addition to their usefulness as satellite antennas, these antennas have produced excellent results in terrestrial work as well. The 2m antenna is an outstanding performer on FM and SSB, and I find that I use it more than my other 2m antennas. As an indication of this performance, I can hear a distant repeater S7 or S8 on my omnidirectional antenna, while on the Telex antenna it will be +40 dB over 9. I have routinely conducted S9+ QSOs over 115 miles on FM using 80 to 100 Watts.

Conclusion

The Telex OSCAR system is an outstanding performer as a satellite system, and does double duty as a great terrestrial array. Despite the minor problems encountered in construction of the beams, I would recommend this setup as an excellent value for VHF/UHF enthusiasts. Reader Service number 202.■

Kent Morse Key

by Perry Donham KW1O



Kent Industries
Distributed by:
Total Electronic Concepts
PO Box 400
Lincoln MA 01773
Price class: $50 (kit)
$60 (assembled)

Number 32 on your Feedback card

I'll tell you right off that I'm a CW freak. For some reason, I get panicky when there's a microphone in front of me—but give me a Morse key and I'm right at home. I generally use an electronic keyer and my Bencher paddles, but I'll occasionally pull out a straight key and pound brass for a while. I enjoy the cadence of hand-sent code; it tends to relax me.

You can imagine my glee, then, when I was asked to review R.A. Kent's solid-brass key. I had admired them at shows and often thought of buying one, and here it was in my shack!

The keys are sold as kits or as assembled units. Mine arrived assembled, so I can't tell you if it's difficult to put together. My guess is that it's not hard at all, judging from the way things fit together so nicely and the clarity of the instructions. The brass parts are apparently hand-turned and beautifully brushed. A ham visiting the office happened to be a machinist, and I showed him the key. The fellow was beside himself! "Look at the way they've knurled these knobs! Look at these little shoulders on the fittings!" I was afraid that I would have to frisk this guy when he left.

The base is finished oak, a nice complement to the color of the brass. The whole unit is quite heavy and doesn't slip even during vigorous bouts of pileup breaking. The knob is a large Navy-type, the kind with a platform.

I should stop going on about how nice the thing looks and talk a bit about its feel. It feels just as good as it looks! The action is very firm and can be adjusted finely. The contacts are solid silver, and I noticed none of the clicking or arcing usually found in keys of lesser quality. My arm got tired after fifteen or twenty minutes of operation because the key is tall—I prefer something like a J-28 that rides very low to the table. It takes a well-developed wrist to work the Kent key, but the action is extremely smooth due to the circular bearing races and the close tolerances of the brass pieces.

"If you love Morse, you'll certainly appreciate this work of art."

Obviously I like this key. I would suggest that Kent make a little brass plate to go on the oak that could be engraved with a callsign; it would be perfect for presentations. If you love Morse, you'll certainly appreciate this work of art. The keys are made in Britain, but you can get one from Total Electronic Concepts, Kent's American distributor. For more information, check Reader Service number 203.■

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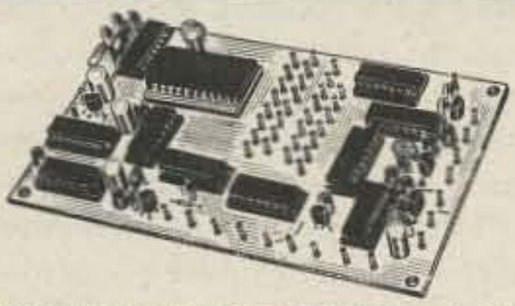

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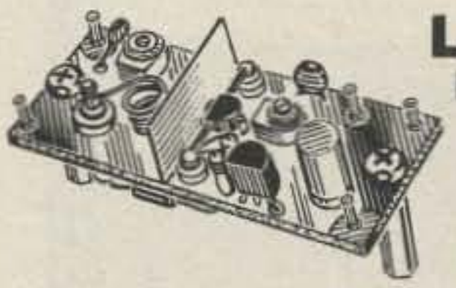

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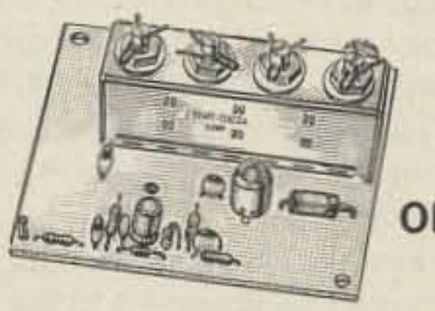

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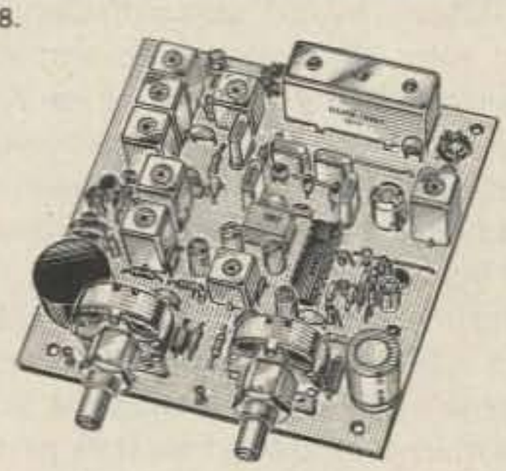

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50-54	144-148
144-146	28-30
145-147	28-30
144-144.4	27-27.4
146-148	28-30
220-222	28-30
220-224	50-54
222-224	28-30
432-434	28-30
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(specify band)	27-27.4	144-144.4
	28-30	220-222
	50-54	220-224
For UHF, Model XV4	144-146	50-52
Kit $79	144-146	28-30
Wired $139	28-30	432-434
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"When You Buy, Say 73"

Sony AIR-8 Scanner

by Marc Stern N1BLH

Sony Corporation of America
Sony Drive
Park Ridge NJ 07656
Price class: $269

Number 33 on your Feedback card

Have you ever wondered why some manufacturers do the things they do? Take Sony, for instance. The giant electronics firm recently entered the hand-held scanner market.

Now you'd think that with Sony in the game as a major player, the other hand-held scanner builders—Regency, Uniden/Bearcat, and Radio Shack—would have something to worry about. After all, Sony is the company that capitalized on the success of its Walkman/Watchman/Everythingman personal electronics devices, as well as its television receivers. But, after using and evaluating the AIR-8 from Sony for several weeks, I can say that the others have nothing to worry about. In fact, it has to make you wonder about the company's ultimate commitment to the receiver market or at least what its perceptions of that market are.

For starters, it's hard to judge exactly what this scanner is. It attempts to be five things to five different users. On one hand, it includes the AM broadcast and LF bands, so the AMer or LFer might be served by it. On the other hand, it also has the FM broadcast band (where you can hear the latest in hard rock, I suppose). But what does this have to do with scanners? Further, it covers VHF from 136 to 174, and it covers the aeronautical band.

So, who's supposed to be the buyer? Everyone, I guess, or those who want to hear as odd an assortment of frequencies as I've seen in any receiver in the last 10 years.

Quite frankly, the AIR-8 seems to me to be more of a token response to the marketplace than a real attempt at taking a significant measure. Why, from one standpoint alone—sensitivity—the others have absolutely nothing to fear.

During my evaluation, I compared received signals with my Kenwood TR-2600 and its standard rubber-ducky antenna and the AIR-8 with its huge—11-inch—floppy, rubber, helically wound antenna. In almost every instance, the AIR-8's received sensitivity just wasn't up to snuff. Local repeater conversations that were 40+ on the HT were noisy on the AIR-8 and tended toward motorboating as if the signal were multi-path.

Now you might think that this would indicate the AIR-8 is even more sensitive than the Kenwood because it was hearing multi-path where the Kenwood was steadfastly picking up the signal. However, it must be realized that the Kenwood's S/rf meter needle was pegged, and I really don't think the scanner, which is a compromise device to begin with, was nearly as sensitive.

As further proof, there are several packet stations on 145.01 in my area that are STRONG on just about any other receiver I have in my shack. On the AIR-8, I could barely hear them.

Another indication of the inability of this scanner was shown to me by the same packet stations. As I was listening to a busy local repeater more than 1.6 MHz above the packet frequencies, I suddenly heard the telltale "braaap" of one of the locals. The packet burst was coming through the AIR-8 and was being superimposed on the FM phone signals I was listening to.

To be fair, I do live in a high rf region. There are more public-service, common-carrier, land-mobile, satellite, and trunked radio services in this area than in any other local area that I know of, and it seems my home is in the center of the signals.

But this still doesn't account for the fact that there seemed to be image signals at the low end of the air band—radio stations overpowering other signals—that were roughly 10.7 MHz removed from their fundamental frequencies. Further, why the manufacturer chose to start the air band just above the FM broadcast band is a mystery to me.

And, it's a feature that overpowers one of the nicer aspects of the scanner. The air band seemed to be where the AIR-8 was most sensitive, and the reception of some big jumbos on their way to this area's major airport was crystal clear. I also heard the control tower at several small airports and talk-around between the tower and planes. So, it makes you wonder.

It also makes you wonder why a rig that should be state of the art really isn't. Take birdies and images, for instance. As you scan through the public-service (PS) band (VHF), you find the scanner locking up all over the place and you hear image signals, signal-related emissions, and birdies. The scanner seems to lock up about two or three times per hundred kHz of band scanning. Those lockups occur from birdies and images, as well as from signal-related noise.

Again, this could be a product of the high rf environment surrounding the test site. But, on the other hand, the other scanners that are around here have few of the same problems. In fact, about the only problem the Sony has in common with the others is synthesizer-related birdies, which are endemic to this type of rig.

Another point to question is the AIR-8's scanning. There's no resume scan feature. Most other scanners include resume scan after carrier or resume scan on time as standard features. However, the Sony is a throwback to the days when scanners had to be restarted manually. Hitting the + or − key on the front panel starts up the scanner until it gets to the next noise point.

And, speaking of those buttons, they are laid out on the front at an angle rather than being placed vertically or horizontally. I can't guess the ergonomic reasons for putting the execute (command) key in the upper right, the keypad slanted 10 or 15 degrees, and the other keys at various angles as well because I wasn't in on the design phase of this receiver. But I can say that it is a rather unusual layout, which is neither intuitive nor particularly easy to use. Restarting a scan requires a hunt for the key among five keys in the bottom of the front panel.

While I'm on the topic of the front panel, the liquid-crystal display is dim and hard to read in just about any light and at any angle. The best angle I came across during the review was about 45 degrees, which is the angle that's right for nearly all LCDs. The only problem that arose was that the hand-held scanner had to be kept at that angle, which defeats the purpose of this portable. At any other angle, you really couldn't see the readout. The green background light was unusable because it lit the display only to a low level.

The controls at the top were also interesting. You must remember to press on them to access the features because they are locking pushbuttons. The automatic squelch is a laudable feature; however, it makes the volume impossible to increase or decrease unless you remember to push the button.

To its credit, the Sony pocket scanner has very good audio rendition, which rivals full-sized scanners. The basses are rich and the highs are fairly full. The midrange is emphasized, but the top and bottom ends of the voice spectrum haven't been forgotten.

Further, each radio service that's covered has its own set of memories—10 per service—which is convenient as you move through the rather diverse set of services that are covered. The only problem with this is that the memory scan display consists of a barely visible little dot moving through a range of little dots on the right of the screen.

Finally, the antenna connector is a low-loss

BNC type, so insertion losses are minor and the AM antenna requires a separate miniature plug and can easily be confused with the earphone jack in the dark.

Perhaps the most troubling piece of this picture is the scanner's memory. It is totally volatile: If you take the power off it for more than a moment or two, there goes everything you've programmed.

This wouldn't be such a problem except for the fact that this scanner is a battery hog. A fairly fresh set of batteries gave out in less than six hours, and a new set in about eight. Replacing those batteries meant opening the cover and removing them. But, as the instruction book for this device states, removing the batteries for more than a minute or so wipes out the memory. So remember to be quick about battery changes if you buy this scanner.

This makes me ask why, in this day of nonvolatile RAM, Sony couldn't have included a capacitive charge which would have held memory for a long time, or why it couldn't have included a long-lasting small battery for memory retention. There is a NiCd pack available from Sony.

Altogether, then, if you're in the market for a hand-held scanner, take a look at the Uniden-Bearcat, Regency, or Radio Shack series. They are far more sensitive and meet the needs of the average amateur better. There seems to be a lot of potential in the AIR-8, but it certainly hasn't been realized yet, and I would urge you to wait until it is. Reader Service number 204.■

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Replace your big, noisy relays with tiny, quiet transistors.

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Since their early days, transistors have been used as switches in dc circuits. Back then, the only limitations were low power dissipation and low breakdown voltage. Now, high-voltage, high-wattage switching transistors are available at a fraction of the price of the old unreliable and now obsolete semiconductors.

While reviewing the basics of dc switching, I'll discuss the modification of an old Standard Horizon 2. Keep in mind that all procedures are applicable to any kind of transceiver, including tubed SSB models.

In the first part of this two-part article ("Make the Switch to PIN Diodes," October, 1986), I discussed the design of a new antenna switching circuit for the Horizon, using PIN diodes instead of relays. This time I will review the circuits used for 12-V-dc switching using semiconductor devices instead of mechanical units.

What Is a Switch?

Since we intend to switch, let's review some switching fundamentals. The ideal switch is one that will have infinite resistance when open and a zero contact resistance when closed. It should have no power dissipated within it, and drive power must not be necessary to hold the switch in either an on or off condition. In short, it must be 100% efficient! Yes, you're right, such a device doesn't exist. And if we try to replace that hypothetical switch with a transistor, things get even worse!

The transistor is one of the most inaccurate but most widely used electronic devices around. It is so inaccurate that most parameters show a minimum, a maximum, and a typical value. When used as a switch, a transistor is not as spectacular as a mechanical switch and is, in fact, far from ideal. Nevertheless, we can live with it if we are able to control its inherent deficiencies. We can take advantage of the options the transistor offers us and, after taming it, we can switch almost anything. To tame the beast, we must know how it works and a bit about its behavior.

There are two conditions that make a transistor useful as a switch. One is the switch-on condition or "saturation," and the other is the switch-off condition or "cut-off." During saturation—see Fig. 1(a)—the base-emitter junction is forward-biased and the emitter is pushing current into the collector through the base. Under this condition, the collector-emitter voltage is low, the result of a very low internal resistance (1 to 60 Ohms). This is the contact resistance of the switch, which ideally should be 0 Ohms.

For the common-emitter configuration shown in Fig. 1(b), the cut-off condition results when reverse bias is applied to the base-emitter junction; the emitter current is then nearly zero, except for a small inherent leakage current. For germanium transistors, it is necessary to apply a reverse bias because of large leakage current. For silicon transistors, this condition is met when the base bias is just zero.

The combination of both states in a single circuit is shown in Fig. 1(c). The forward and reverse bias is applied by connecting the base resistor either to the collector side to turn the switch on or to the emitter side to turn the switch off.

Transistor Specs

The most important parameters of a transistor are its breakdown voltage, maximum collector-emitter current, maximum power dissipation, beta value, and f_t limits. The breakdown voltage is the maximum permissible voltage that can be applied to the unit. The maximum collector-emitter current is the maximum current that can be switched. Maximum power dissipation in Watts is the maximum allowable current at a given voltage. Beta is the figure that reflects current amplification. F_t is the parameter that tells you the maximum frequency at which the transistor can be used with no performance degradation.

The power dissipation of a transistor is given by the sum of the base current times the base-to-emitter voltage, plus the collector current times the collector-to-emitter voltage. The power switched by a transistor is given by the product of the maximum collector voltage at cut-off and the maximum collector current at saturation. Always use a transistor with a power dissipation well above the power to be switched. Use Ohm's Law to check your circuit limits, remembering that the maximum collector current given by the manufacturer can often be exceeded without damage because at the time of switching the emitter-collector voltage is very low. On the other side, exceeding the breakdown voltage is *always* dangerous, as is exceeding the rated power dissipation.

With the simple circuit shown in Fig. 1(c) you can replace the relays in almost any radio. Some tricks are necessary to combine the simple normally open PTT switch with the solid-state SPDT switch needed to toggle the power source to the receiver and to the transmitter.

Switching the Transmitter +12 V Dc

Now, let's go into our business of switching. First I will analyze the circuits used in modern transceivers for switching +12 V dc in the transmitter. The first thing to determine is where to break the supply. Old equipment with relays used to change the +12-V-dc supply line between receiver and transmitter sections. This procedure does not apply for transistor switching since the total transmitter current would flow through the transistor. This makes very little difference for a relay; most relays used for switching are rated in the high-Amps category. In using switching transistors, though, it is important to know how much current will flow through them.

The way to overcome this limitation is to maintain the 12 V dc permanently in the high-level stages (PA, driver, pre-driver, and so on) and switch the dc pow-

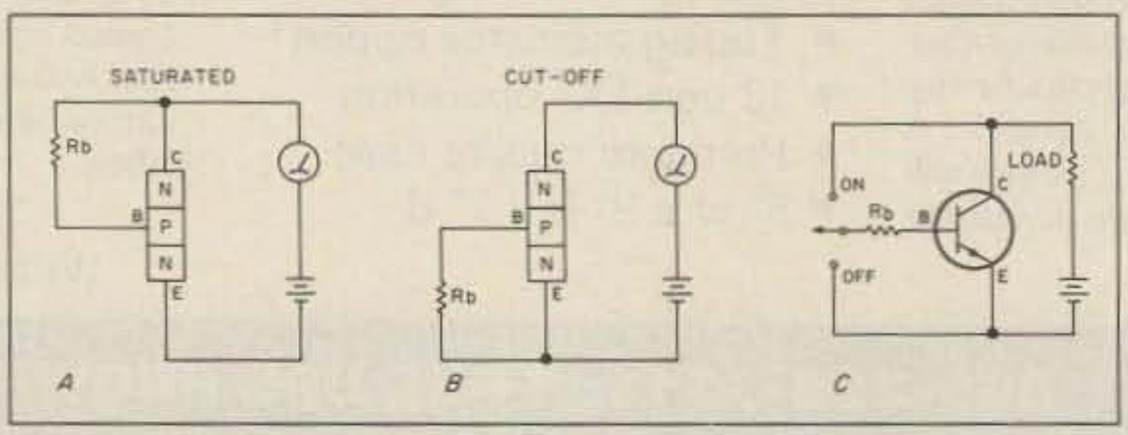

Fig. 1. Transistor saturation (a) and cut-off (b) make the device useful as a switch. The circuit in (c) is a simple way to switch a load on and off.

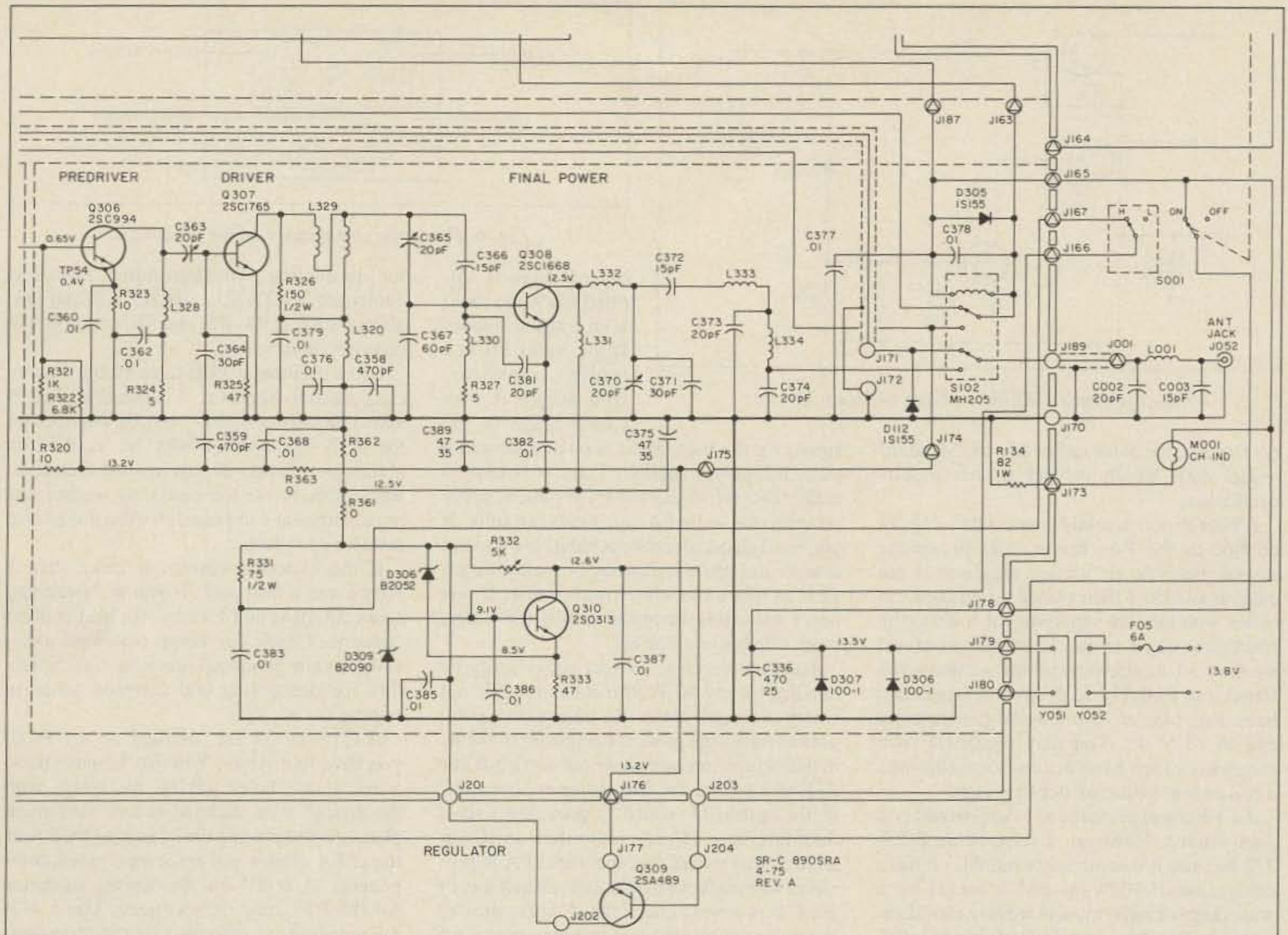

Fig. 2. An example of a radio which can easily be modified to solid-state switching.

er only at stages using less current. This way, the transistor used would be less costly and the dissipation requirements would be less restrictive.

To modify an older radio, it is very important to ensure that those stages that will have permanently applied 12 V dc will not self-oscillate. Otherwise, you run the risk of permanent spurious emission that may cause interference, yield a burned final transistor, or result in a call from the FCC monitoring station. That would be a smack in the eye!

Modern transmitters using better PA transistors and better designs are less prone to oscillation. This is *not* the case with old solid-state VHF and UHF transceivers! The easiest way to test the radio for self-oscillation is to press the mike PTT when you have a wattmeter installed at the output. Then, pull the crystal of the corresponding channel and watch for a drop in power. The power should go to *zero*. Sometimes the spurious emissions are as high as the normal rated power output for the radio! But be aware, and check for power on the order of milliwatts, too. The best procedure is to use a spectrum analyzer. Don't get discouraged if you don't have such an instrument—instead, a through-line wattmeter, swr meter, or rf voltmeter may be used.

Now, if no power is detected while the PTT is pressed, plug the crystal back in and try a few minutes of continuous operation on a dummy load in order to raise the temperature; then repeat the procedure. Be reasonable—do not bake the radio until it melts. Spurious emissions are very often caused by overheating in a poorly designed (or cheap) radio. A caution is in order: Some radios generate spurious signals due to poor design or misalignment, but this is not *always* the case. Occasionally a defective transistor or capacitor in a critical circuit may be the culprit. Don't overlook misalignment; use common sense and read the service manual.

It is important to recall that a transistor will drop some voltage due to its internal resistance. This is the most important consideration in selecting the transmitter stages that will be permanently connected to +12 V dc, for the higher the current demand, the higher the voltage drop. That's why I recommended that the switching be as far as possible from the PA stage—otherwise you will need a high-wattage transistor and a large heat sink.

Fig. 2 shows a portion of the diagram of a typical radio, like the one we are modifying. The relay breaks the transmitter +12-V-dc line when the radio is in receive mode. In this condition no power is applied to the transmitter stages. I have checked the Standard 890-L and found no oscillations or spurious emissions when the crystal is unplugged. This is

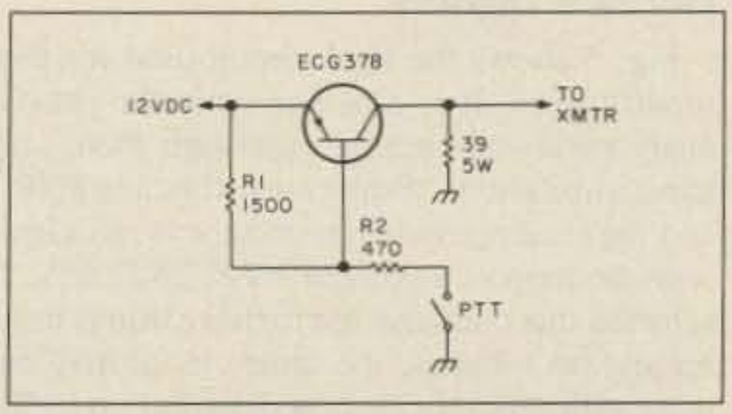

Fig. 3. Circuit for switching 12 V dc to the transmitter.

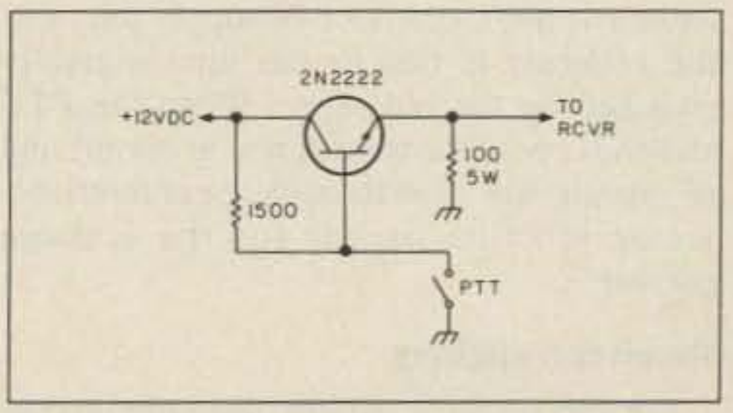

Fig. 4. Circuit for switching 12 V dc to the receiver section.

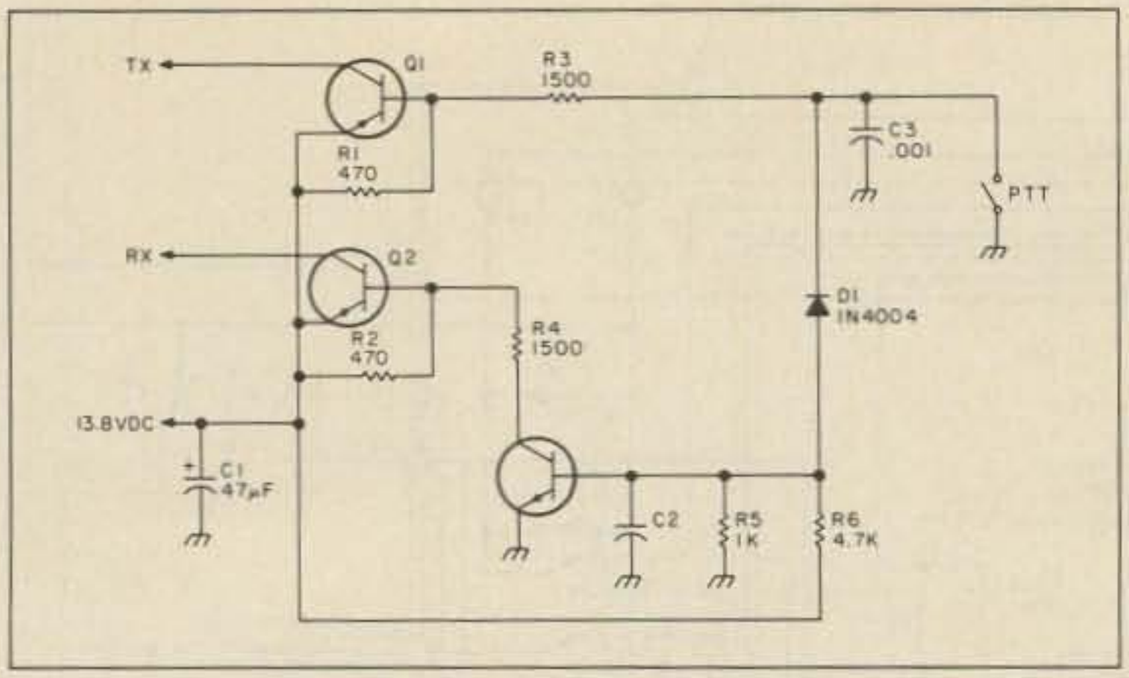

Fig. 5. Complete TX/RX voltage switching circuit.

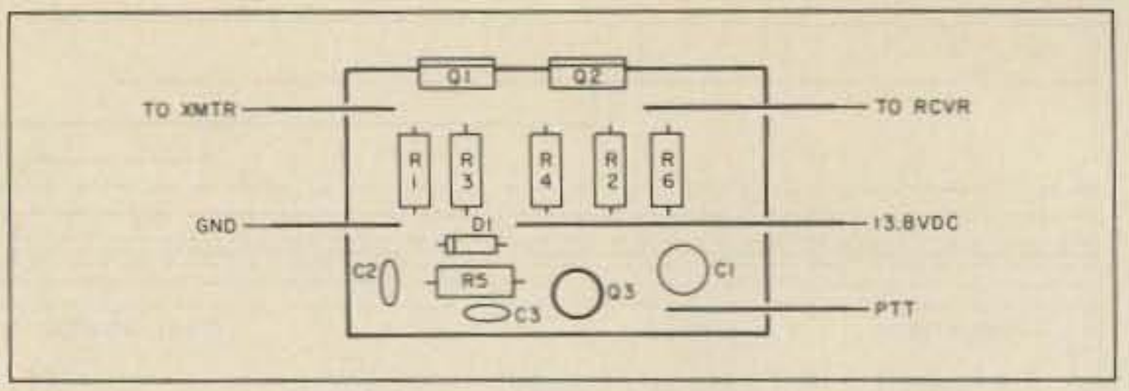

Fig. 6. Parts placement diagram for the switch.

not the case for older radios like the Standard model 803, which is very prone to self-oscillation.

I chose to permanently connect the +12-V-dc line to the PA, driver, and pre-driver stages, since the dc voltage regulator is not easy to switch. I then placed an ammeter in series with the line supplying 12 V dc to the remaining stages to check the current drawn by the rest of the transmitter section—and found it to be 0.115 A. Note: All stages that have a dc bias of zero may be permanently tied to 12 V dc. You may recognize such stages since their bases are connected through a coil or low-value resistor to ground.

A PNP transistor rated to 1 Amp would be a good choice. However, I selected an ECG-378 because it was already available. It has a dissipation of 50 Watts and is useful for a wide range of radio models without modifications. In this case, over-specifying is intentional and has very little effect on the cost.

In my radio, no heat sink was needed since the current involved was very low. The circuit in Fig. 3 shows an approach that may be used to switch from 5 volts to 60 volts at several Amps if a heat sink is used. Since the ECG-378 is a TO-220 packaged transistor, it will be no problem to affix it in any large metal surface within the radio.

You should use a separate heat sink if the switched current is more than 5 Amps. A caution is in order: Do not try to switch a higher current with this circuit unless a large drop in voltage is acceptable. Remember that a transistor is far from being an ideal switch due to its large internal resistance. If you need large-current switching, a different approach is necessary and is also out of the scope of this article.

The 1,500-Ohm and 470-Ohm resistors furnish the required base bias to Q1. The emitter is tied to the 13.8-V supply line, and the collector is tied to the line originally switched by the old relay. When the PTT switch is open, the transistor is at cut-off and no current will flow through the emitter-collector junction except for the leakage current.

Receiver Switching

For the receiver, follow the same procedure. Many modern radios do not switch the line supply for the audio PA; some sort of cut-off bias is applied when the radio is in transmit mode. If the audio PA is a typical transistorized stage, it may cause noise in the speaker if the transmitter is on and the audio stage has power applied. Thus, it is wise to make this test: Press the PTT switch, apply power to the audio PA, and listen carefully. If you have an oscilloscope at hand, use it to see if there are any oscillations or undesired effects in this stage while transmitting. If you don't have this instrument, use the older, more reliable one: the ear.

The total receiver current could easily be handled by any 50-Watt transistor, so do not worry too much about this unless your radio uses a really high power af amplifier or the IC manufacturer recommends not to switch the audio PA on and off. The Horizon 2 has an IC in the audio PA which is provided with a disabling bias. If your radio uses an IC for audio, chances are that the audio PA is provided with such cut-off facility, even if it isn't used. It is wise to check the IC specs or read the radio service manual to know how your radio works.

The circuit used in the receiver (see Fig. 4) is similar to the one used for transmitter switching. Check the receiver total current with the volume control at maximum. Using a milliammeter in series with the power source, I found 0.170 A of drain for the Standard 890-L. The transistor I chose is a 2N2222 NPN-type rated at 800 milliwatts, well above the current demand. The resistor is used to forward-bias the transistor that will be at cut-off condition when the PTT is pressed.

Another caution: Although I have defined the supply voltage as +12 V dc, remember that most radios are designed for 13.8 V dc. Use this figure when doing any calculations. Perhaps you would like to check the circuits using Ohm's Law. Very interesting things can be discovered.

Putting It Together

Fig. 5 shows the final circuit used for the modification. It is different from the previously reviewed circuits—although there are some similarities. Both transistors are PNP, and the receiver switch transistor is switched with the help of a popular NPN 2N2222A. I selected this combination to make things easier and, as a bonus, the same circuit may be used with different current drains of up to 50 Watts of dc power. Diode D1 is used to isolate both switches. The capacitors are used for decoupling. The transmitter switch is composed of Q1, R1, and R3. Q2 and Q3, along with R2, R4, R5, and R6, comprise the receiver switch.

Use a perforated PCB to assemble the circuit; place it wherever it is possible. Fig. 6 shows the layout with Q1 and Q2 mounted on the PCB. Q1 and Q2 may be fixed in an aluminum bracket or just against a chassis. Remember to use the insulating washer and mica with heat compound, for the flange is at positive dc voltage.

If the expected current is more than 5 Amps, use a heat sink. If you are switching some 500 mA, don't worry, for heat is of no concern. Check for noise, spurious emissions, or any abnormal function. Use capacitors for decoupling and common sense in routing the wiring.

If Q1 and Q2 are installed on the PCB, you have four wires. You may connect these wires at the holes left by the relay, with the ground wire soldered at any convenient place. Avoid placing the switching PCB near the rf PA circuit and associated tuned components. A 0.001-mF decoupling capacitor for the PTT may be necessary. Use a 4.7-mF tantalum cap in the receiver and transmitter switched lines. Now check the radio and enjoy your solid-state modern switching. Very soon you will forget what a relay click sounds like!

This same procedure may be used for HF radios and of course you may use some of the high-voltage transistors already available. There are transistors rated from 100 to 1,600 volts and up to 30 Amps. Don't forget to check the collector dissipation and don't go far from the specs. Even if the transistor is rated at a breakdown collector-base voltage of 1,100 volts and a collector current of 1 Amp with a collector dissipation of 40 Watts, *don't exceed the power dissipation.*

I modified 50 Standard 890-L units that had obsolete relays, and all are performing very well. Before undertaking any modification, you should get the service manual for your radio. Study the block diagram and the schematic and thoroughly plan the modification—before breaking the unit to pieces. Test the switch in a breadboard, watching for heat buildup, but remember that your radio is not designed for continuous operation. In any event, save the dismounted parts in order to replace them if anything goes wrong. If you are comfortable with a soldering iron but don't have modification skill, have somebody assist you. If you send me the schematics and enough information, I will assist you as much as I can, but please don't forget an SAE and enough IRCs for postage. ■

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Don't toss that fried circuit board—in a couple hours the smoke will have cleared and your PCB will be working again.

Number 2 on your Feedback card

Lurking inside any complex electronic equipment is the potential for catastrophic failure, which can convert an expensive piece of equipment into so much junk. A friend of mine experienced this phenomenon recently when his two-meter rig developed a short and poured out billows of smoke. As this rig was mounted in an airplane he was piloting at the time, he became very excited very quickly. Safely back on solid ground, he sought my help.

Most good-quality radio equipment has at least one very expensive circuit board. A law credited to some fellow named Murphy warns us that failure is most likely to occur in that particular circuit board, and that when it happens it will probably be spectacular—as it was in this case. A shorted capacitor in the audio circuit burned several components and charred the circuit board so badly that repairing it seemed to be a hopeless task!

We all know that sometimes repair parts are not easy to come by, especially those that aren't normally replaced—such as an entire circuit board. If you do eventually find a source for the parts (not necessarily the dealer who sold you your fabulous radio), it could cost approximately an arm and a leg. Cost may not be the only deciding factor. Sometimes you do not have the time to wait for a replacement circuit board. Unless you can spare the price and time, a repair such as the one I employed could make your equipment operational.

As I considered the damage, it occurred to me that only the burned part of the board needed replacement. If a patch could be devised to replace this area, the original board could be used again. It would be necessary to make the patch fit securely and to etch the copper to match the original traces, but these would not be insurmountable difficulties.

Using a jeweler's saw with a fine blade, I cut away the burned area, taking care to cut in the most advantageous way. That is, if I noticed that most of a conducting trace had been removed, leaving only the solder pad, I was careful to cut away the solder pad as well. I then cut a matching patch for the damaged area from a piece of circuit board that was as nearly identical as possible to the original board. In order to achieve a snug fit, I cut the patch a bit large and filed it. The board and patch are illustrated in Fig. 1 and Photo A.

Since the patch was small and its foil pattern relatively simple, I decided to etch the patch by hand after securing it in place. Had it been more complicated, I would have etched the board by chemical means before securing it on the board.

When the patch fit snugly, I glued it into place using epoxy. The pieces were clamped and allowed to dry overnight so there would be no danger of them shifting during the rest of the patching operation. In the meantime, I studied service literature and the burned piece to try to reproduce the pattern of the traces. Happily, I found an identical transceiver, so I could copy the board layout in rebuilding the patched board.

Using dividers, a ruler, and other equipment, I marked and drilled component holes in the patched area to match the original component placement. Using these holes as points of reference, I drew in the lines for the conductor tracks, ensuring that they joined the existing tracks at the border of the patch. Etching was accomplished by simply cutting away the unwanted copper foil using a small knife.

With the finished patch in place, I bridged the breaks in all the traces where they crossed the border of the patch, soldering fine wire jumpers across the cuts. The components were then installed, replacing the burned ones, and the board was ready to be returned to service. The patch was distinguishable only because the original board had a protective coating that made it a darker green.

The repair of this circuit board required only a few hours, spread over a couple of days. It required far less time than would have been needed to obtain a replacement board. Also, it cost considerably less, yet it seems to operate as well as a new board. Thanks to the interlocking construction, it is virtually as strong as the original. I have found the repair to be very satisfactory, and this procedure has given me one more way to deal with burned circuit boards. ■

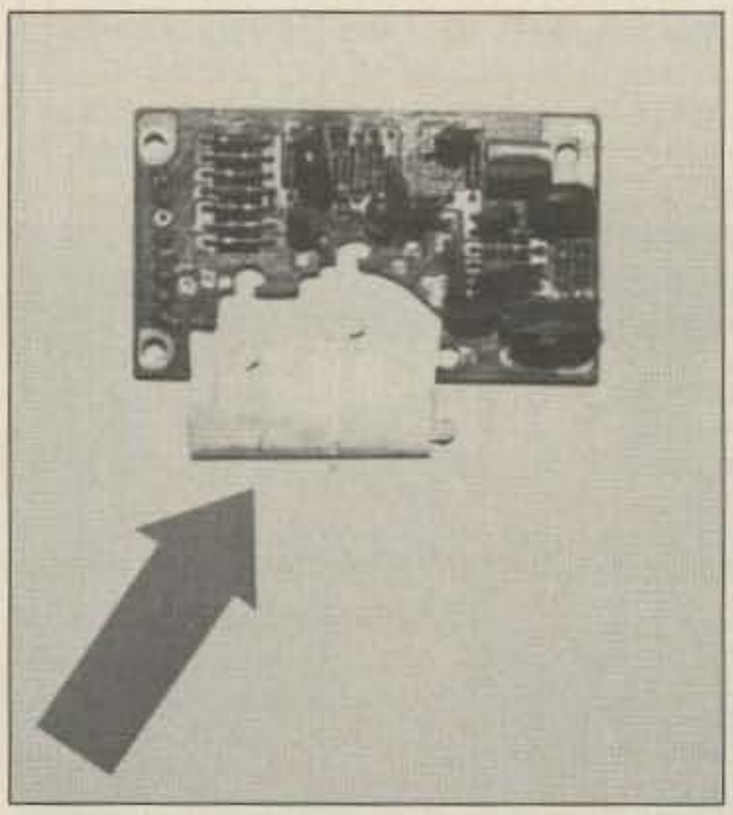


Photo A. The patch ready to be inserted.

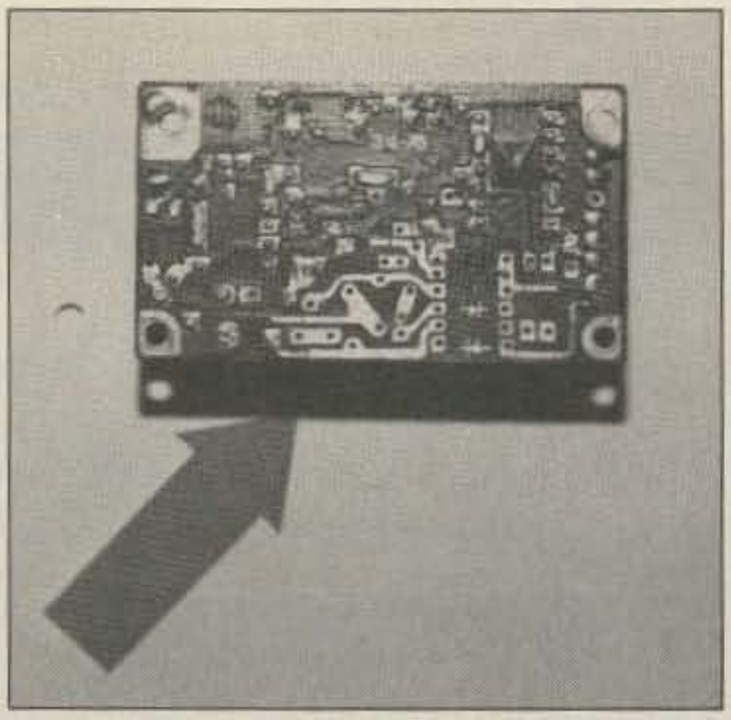


Photo B. The repaired board.

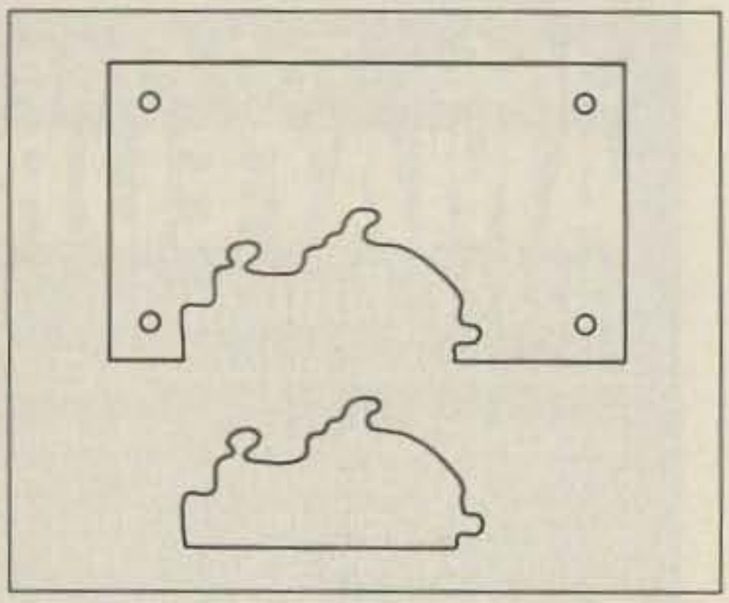
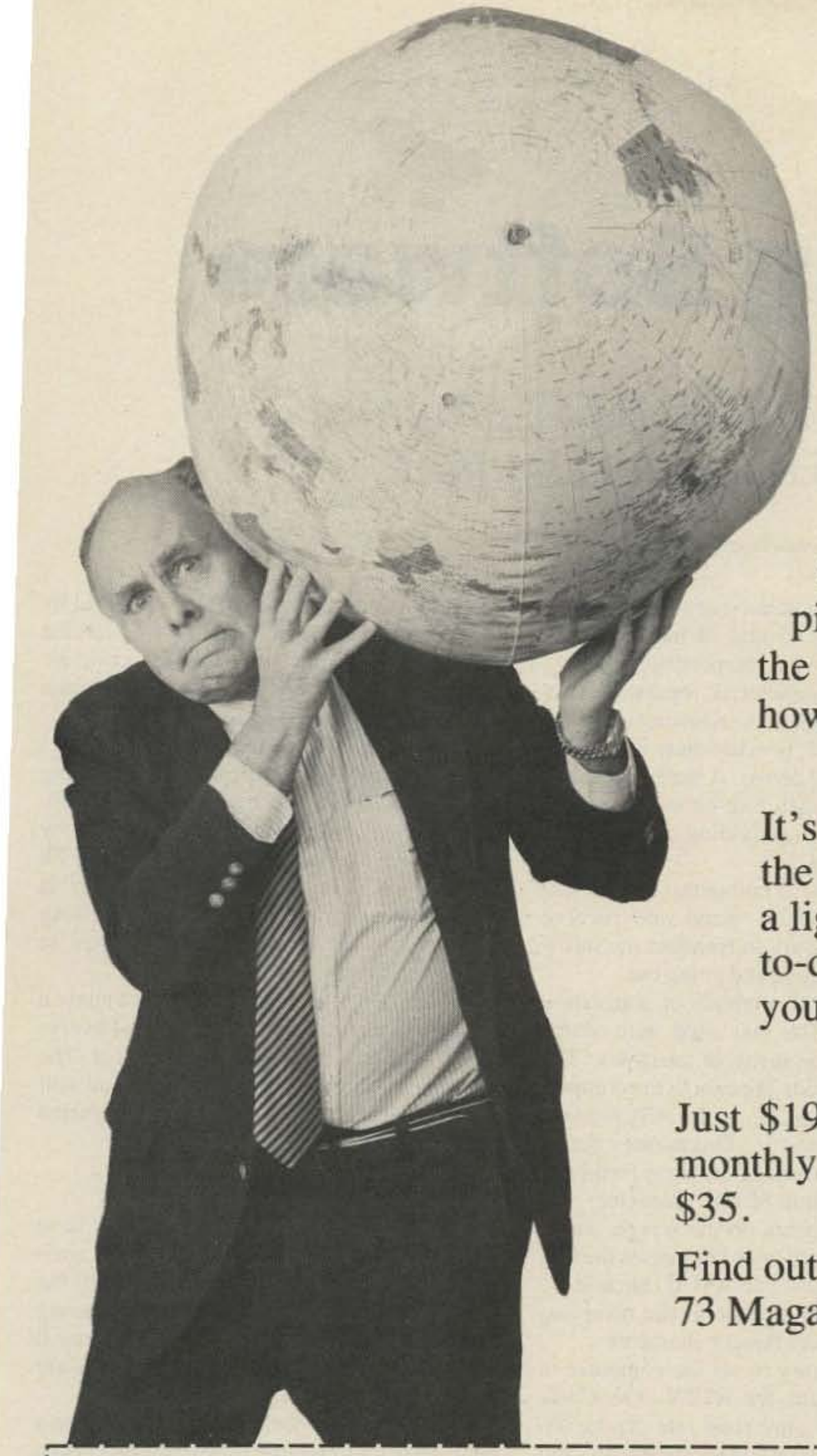


Fig. 1. Patch for a damaged circuit board.



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Shoestring Software

This no-frills C-64/VIC-20 RTTY program will give you 45 baud on a budget.

Number 3 on your Feedback card

Since my article "Shoestring RTTY" appeared in the January, 1985, issue of *73*, I have had inquiries from hams who are interested in writing their own software in addition to building their own interface.

I set out to write a short program that could be typed into a Commodore 64 or VIC-20 computer easily, and one that would provide transmit and receive RTTY operation. The resulting software doesn't have a lot of frills, such as a split-screen display and a type-ahead message buffer, but it does have message strings, T-R switching, and two-speed (60- and 100-wpm) operation. It will work with any interface, commercial or home-brew.

How It Works

Since all computers are designed to interface with the outside world (usually through telephone lines), most of the communication software is already built into the operating system. On Commodore machines, just one OPEN statement sets the baud rate, number of bits in a word, parity, simplex or duplex, and other parameters. There are two 256-character buffers which store information received and information to be sent.

The language used by all computers is ASCII, and there are many standard baud rates—110, 300, and 1200 baud being the most common. The ASCII word is usually eight bits long. If RTTY communication used, say, 300-baud ASCII, then writing a terminal program would be almost trivial. However, the language used is Baudot, and most ham communication is at such non-standard baud rates as 45 and 74 baud, usually called 60 and 100 wpm, respectively.

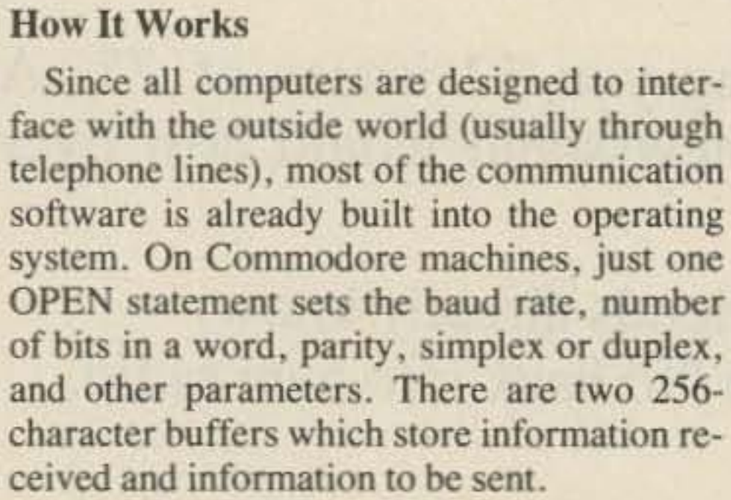


Fig. 1. Computer-interface connections. Numbers in parentheses refer to pin numbers of U3 (Fig. 3).

Each Baudot character is represented by five bits of information, allowing only 31 possibilities (not 32, because there is no character containing all zeros). A shift command, however, allows each five-bit word to have two meanings, thus providing a total of 62 possible characters.

In order to make a computer—which understands only ASCII—send and receive Baudot, it is necessary to translate the information both coming in and going out.

There are several methods of translating between codes. The one used here stores ASCII values in an array of variables. The received Baudot code appears to the computer to be five-bit ASCII, so the ASCII value will be between 1 and 31. This number points to a particular element of the array, which is the real ASCII value of that character. The character then appears on the screen. Likewise, pressing a particular key causes the five least significant bits of an ASCII character to be sent, which will appear to the receiving station as the correct Baudot character.

It is also necessary to set the computer to the right baud rate for RTTY. On Commodore machines, any baud rate can be obtained by setting two RAM locations (665 and 666) to the correct bit time for that baud rate. The program, as written, provides the two most commonly used baud rates, 45 and 74. If you wish to experiment with different baud rates, change the following program lines:

```
380 PRINT:INPUT "BAUD RATE";BR:R=INT
    (1.023E6/BR+.5):Q=INT(R/256)
```

and

```
381 POKE 665,256*(R/256-Q):POKE 666,Q:
    RETURN
```

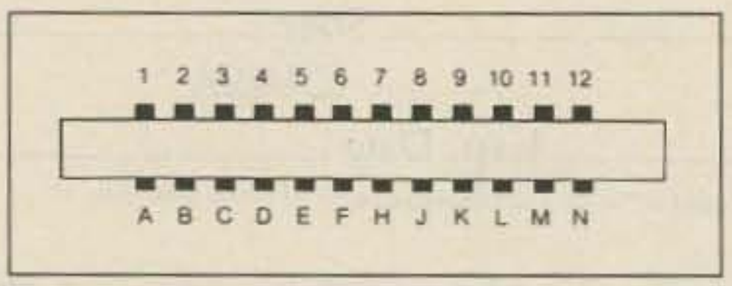


Fig. 2. User I/O port, rear view.

All the program commands are handled by the function keys (see Table 1). Pre-defined messages are sent by pressing keys F1 through F6; each key accesses a subroutine containing the appropriate message.

The first subroutine (corresponding to F1) begins at line 410, the second (corresponding to F2) at 420, and so on, up to F6 at 460. Transmit/receive switching is controlled by F7, and F8 changes speed. Both F7 and F8 are toggles; that is, each time the key is pressed, the opposite action occurs. Pressing F7 when in the receive mode switches to transmit and vice versa.

Incidentally, the program does not allow a switch from transmit to receive until everything in the transmit buffer has been sent. The computer will print STILL SENDING and will switch to receive as soon as the transmission has been completed.

Typing the Program

Extra spaces and remark statements have been placed in the listing for increased readability and as a guide to understanding the function of each part of the program. Leaving out the REM lines and the extra spaces will save time (and memory, important if you are using an unexpanded VIC).

I have a daisy-wheel printer, so it may be a little difficult to tell the difference between a zero and a letter O. Just remember that O's appear only in words and Basic keywords; everything else is a zero.

Customize the message strings as you go through that part of the program. Insert your own call, name, QTH, equipment, etc. Message strings of up to 256 characters

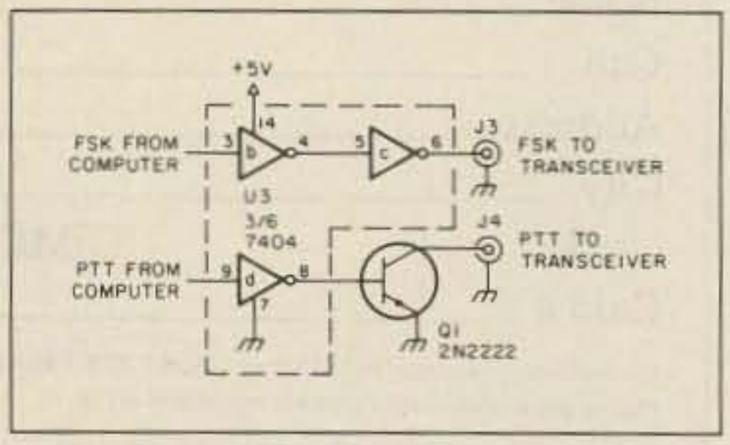


Fig. 3. U3.

can be created by linking program lines together. Lines 460 and 461 show an example of this. Lines 450 and 451 demonstrate how a line can be repeated. The "CQ . . . DE callsign . . ." string is repeated three times followed by "K K." After the final statement defining each message string, don't forget to add ":RETURN" to complete the subroutine.

The program listing is for the Commodore 64. For the VIC-20, change the following lines:

```
20 POKE 37138,32:POKE 37136,32
370 IF T=0 THEN POKE 37136,0:T=1:PRINT:PRINT
    "TRANSMIT MODE":RETURN
371 S=0:FOR I=1 TO 8:S=(PEEK(37148)-238) OR
    S:NEXT
372 IF S*T THEN PRINT:PRINT "STILL
    SENDING":T=0
373 IF S THEN 371
374 POKE 37136,32:PRINT:PRINT "RECEIVE
    MODE":T=0:RETURN
```

If your VIC has no memory expansion, keep all the message strings short and omit lines 451 and 471.

When you have finished typing in the program, make a copy to tape or disk before running it. You can check it out off the air by connecting pins B, C, and M of the user I/O port together. Switch to transmit mode, send up to 256 characters, then switch back to receive. The receive buffer will be emptied to the screen, and you should see exactly what you typed in or sent with the function key messages. If there is a discrepancy in a particular character, that means there is an error in one of the DATA statements.

Once everything is working off the air, you are ready to connect the interface to the appropriate pins on the user port, which will require a 12/24 card edge connector. See Fig. 1. (A good source for this connector is Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002.) Note that all connections are made on the bottom side of the connector. It is a good idea to mark the top of the connector, since it is possible to insert it either way. The computer or the interface could possibly be damaged by upside-down insertion.

The only thing left to do now is to get on the air and start enjoying RTTY. ■

Key	Function
F1	Send RY string
F2	Send name and QTH
F3	Send DE callsign and name
F4	Send rig info
F5	Send CQ
F6	Send computer info
F7	T-R switch
F8	Change speed

Table 1. Function key commands.

```
0 REM
1 REM  ******************************
2 REM  *                            *
3 REM  * SHOESTRING RTTY SOFTWARE *
4 REM  *     FOR COMMODORE 64       *
5 REM  *  BY DAVID OLIVER  W9ODK    *
6 REM  *                            *
7 REM  ******************************
8 REM
9 REM
10 OPEN 2,2,0,CHR$(101)+CHR$(16)
20 POKE 56579,32:POKE 56577,32
30 FL=1:M=0:T=0
40 DIM RC(64),TC(64):RESTORE
50 FOR I=1TO62:READ RC(I):NEXT
60 FOR I=1TO60:READ TC(I):NEXT
70 PRINT CHR$(147)CHR$(17)"RECEIVE MODE"
:GOSUB 380
80 GETA$:IF A$="" THEN 100
90 IF ASC(A$)>132 AND ASC(A$)<141 THEN
 400
100 IF T=0 THEN 300
110 IF M=0 THEN 150
120 FOR I=1 TO M :A$=MID$(M$,I,1):IF I=M
 THEN M=0
130 GETZ$:IF Z$=CHR$(13)THEN M=0:GOTO 80
140 REM    SEND ROUTINE
150 IF A$="" THEN 270
160 PRINTA$;
190 A=ASC(A$)
200 IF A=13 THEN A=91
210 IF A=32 THEN A=92
220 IF A<33 OR A>92 THEN 270
230 A=A-32:IF A<33 THEN PRINT#2,CHR$(91)
+CHR$(TC(A))+CHR$(95);:GOTO 270
250 PRINT#2,CHR$(TC(A));
270 IF M THEN NEXT
280 GOTO 80
285 REM
290 REM    RECEIVE ROUTINE
300 GET#2,B$:IF B$="" THEN 80
310 B=ASC(B$):IF B<1 OR B>31 THEN 80
320 IF FL THEN B$=CHR$(RC(B)):GOTO 340
330 B$=CHR$(RC(B+31))
340 IF FL AND (B=27) THEN FL=0:GOTO 80
345 IF B=31 THEN FL=1:GOTO 80
350 PRINTB$;:GOTO 80
360 REM     T/R SWITCHING
370 IF T=0 THEN POKE 56577,0:T=1:PRINT:
PRINT"TRANSMIT MODE":RETURN
371 IF PEEK(673) AND 1 THEN PRINT:PRINT
"STILL SENDING"
372 IF PEEK(673) AND 1 THEN 372
373 POKE 56577,32:PRINT:PRINT"RECEIVE MO
DE":T=0:RETURN
374 REM
375 REM     HI/LO BAUD RATE
380 IF PEEK(665)=236 THEN POKE 665,72:PO
KE 666,53:PRINT:PRINT"100 WPM":RETURN
381 POKE 665,236:POKE 666,87:PRINT:PRINT
"60 WPM":RETURN
400 M$="":ON ASC(A$)-132 GOSUB 410,430,
 450,370,420,440,460,380
401 M=LEN(M$)*T:GOTO 100
404 REM
405 REM     MESSAGE STRINGS
410 M$="RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY
RYRYRYRY ":RETURN
420 M$="NAME IS DAVE DAVE. QTH IS SHEVLI
N, MN SHEVLIN, MN. ":RETURN
430 M$="DE W9ODK... DAVE... IN NORTHERN
MN. ":RETURN
440 M$="RIG IS IC720A WITH CLIPPERTON-L
PUTTING OUT ABOUT 500 W. ":RETURN
450 M$="CQ CQ CQ CQ CQ DE W9ODK W9ODK W9
ODK  "
451 M$=M$+M$+M$+"K K ":RETURN
460 M$="USING COMMODORE 64 COMPUTER WITH
 INTERFACE AND SOFTWARE OF MY "
461 M$=M$+"OWN DESIGN. ":RETURN
485 REM
490 REM   DATA FOR CONVERSION ARRAYS
500 DATA 69,10,65,32,83,73,85,13,68,82
505 DATA 74,78,70,67,75,84,90,76,87,72
510 DATA 89,80,81,79,66,71,23,77,88,86
515 DATA 23,51,10,45,32,39,56,55,13,36
520 DATA 52,39,44,33,58,40,53,34,41,50
525 DATA 35,54,48,49,57,63,38,42,46,47
530 DATA 59,23,77,81,84,73,68,90,69,79
535 DATA 82,91,68,76,67,92,93,86,87,83
540 DATA 65,74,80,85,71,70,88,78,94,68
545 DATA 68,68,89,68,67,89,78,73,65,77
550 DATA 90,84,70,75,79,82,92,76,88,86
555 DATA 87,74,69,80,71,94,83,93,85,81
560 DATA 72,68
```

Program listing. "Shoestring RTTY" software for the C-64 (see text for modifications for the VIC-20).

Jim Grubbs K9EI
PO Box 3042
Springfield IL 62708

The Talking Teletype

Put your VIC-20 or C-64 to work chatting away in the shack with this Basic RTTY-to-voice program.

Number 4 on your Feedback card

The computer is a great tool for the handicapped. A large contingent of hearing-impaired individuals use their computers for TDD operation over the phone lines.[1] Comvoice, a recent offering by Genesis Corporation (PO Box 152, Hellertown PA 18055), made bells go off in my head suggesting additional ways that computers could be used to open up new avenues for another group of individuals—those with vision impairments.

The Comvoice program looks like a game cartridge and plugs into the expansion port on Commodore computers. A version is available for both the C-64 and the VIC-20. It is a Votrax-based speech-synthesizer unit with the typical mechanical-sounding voice. In most applications, though, the speech is more than clear enough to be easily understood.

What sets the Comvoice unit apart from other voice synthesizers is that it does not interfere with normal RS-232 operations. The RS-232 user port—where the modem normally connects to the computer—is the easiest access point for sending and receiving serial information like Teletype® signals.

Since many synthesizers tie up the user port, modem or Teletype operation is not possible. Software synthesizers that take advantage of the sound capabilities of the C-64 usually corrupt the hardware interrupts so that the machine is no longer easily usable for RS-232 functions. Comvoice has none of these problems.

RTTY Meets Computer—The Basics

Computers like to speak ASCII code. RTTY, however, uses Baudot, a five-bit code allowing for little more than the alphabet, numbers, and a few punctuation marks. ASCII, with its seven bits, can distinguish between upper- and lowercase and has an expanded set of characters. Commodore ASCII (and others) adds one more bit (for a total of eight), allowing a set of graphics characters as well.

Through software control, it is very easy to instruct the Commodore user port to look for

```
100 goto 360
110 poke 665,r:poke 666,q:
120 pt=56579:rem value for c-64
130 rem for vic-20 pt=37138
140 ls=-1
150 lf$=chr$(10)
160 cr$=chr$(13)
170 l$="e"+lf$+"a siu"+cr$+"drjnfcktzlwhypqobg9mxv9"
180 f$="3"+lf$+"- '87"+cr$+"$4',!:(5')2#601975%./;9"
190 get#2,c$:if c$="" then 260
200 c=asc(c$):if c<1 or c>31 then 190
210 if ls then c$=mid$(l$,c,1)
220 if not ls then c$=mid$(f$,c,1)
230 if us$="y" and c$=" " then ls=-1:rem usos
240 if c$<>"9" then print c$;:gosub 780:goto270
250 ls=(c=31)
260 get a$:if a$="" then 190
270 if a$="l" then ls=-1
280 if a$=chr$(95) then close 2:goto 360
290 if a$="f" then ls=0
300 if a$=chr$(135) then v=2:speak "letter mode on"
310 if a$=chr$(136) then v=1:speak "voice on"
320 if a$=chr$(140) then v=0:speak "voice off"
330 if a$=chr$(133) then goto 580
340 a$=""
350 goto 190
360 open 2,2,0,chr$(96+1)+chr$(0)
370 us$="y":print chr$(147)+chr$(17)+chr$(17);"usos (y/n)"
380 speak "do you want un shift on space answer y or n"
390 input us$
400 br=60:print chr$(147)+chr$(17)+chr$(17);
405 br=60:print "what speed":print "(60,67,75,100 wpm)"
410 speak "what speed"
420 input br
430 gosub 510
440 print chr$(147);" 73 talking rtty rx":print str$(br)+" wpm"
450 speak "73 talking r t t y receive"
460 br$=str$(br):speak br$:speak "words per minute"
470 if us$="y" then print chr$(19)+chr$(17)+chr$(17);" usos on"
480 if us$="y" then:speak "un shift on space on"
490 print
500 goto 110
510 d=1.023e6
520 if br=60 then b=45.45
530 if br=67 then b=50
540 if br=75 then b=56.92
550 if br=100 then b=75
560 x=int(d/b+.5):q=int(x/256):r=256*(x/256-q)
570 return
580 print chr$(147)+chr$(18);" 73 talking rtty tx ":poke pt,32
590 speak "73 talking r t t y transmit"
600 l1$="cyniamztfkor|lxvwjepgs]uq"
610 f1$="mdtidzqorddlc|]vwsajpugfxnddyd"
620 get x$:if x$=""then goto 620
630 if asc(x$)>47 and asc(x$)<58 and v<>0 then:speak x$
640 if asc(x$)>64 and asc(x$)<91 and v<>0 then:speak x$
650 if x$=chr$(34)then x$=chr$(39)
660 if x$=chr$(133) then poke pt,0:a$="":goto 440
```

Basic program to drive the Comvoice speech unit.

serial data in many configurations. The number of data bits as well as stop bits can be specified by the program. With the word length set to five bits, the computer still speaks ASCII, but only pays attention to the first five bits. Through use of a translation table, the computer can be made to print the intended Baudot character, though internally the machine continues to speak ASCII. See the programmer's reference guide for more details about OPENing an RS-232 channel.

Most amateur RTTY takes place at 60 words per minute. Computer types more accurately refer to this as 45.45 baud, which is not a standard baud rate on Commodore computers. But, there are a pair of magic registers that when POKEd to the right values can make the machine operate at any baud rate within its speed limits. Such a routine is included in my program, which also allows for reception of all standard amateur RTTY speeds.

For transmitting, the process is similar but the translation is reversed. When you press a key, the program looks up that key in a table to find what ASCII code "looks like" the Baudot character you wish to send. The result is transmitted to the user port.

The Miracle of Speech

Up to now, I haven't done anything particularly special to make this a talking Teletype program. The changes necessary, though, are minimal due to the way Comvoice implements speech.

With Comvoice in place, an additional Basic command is added. SPEAK does exactly what you would think and is used much like a PRINT statement. By simply adding several SPEAK commands to the existing PRINT commands, you can make the Teletype program come to life with voice. It's here where a few problems begin, most of which are easy to overcome.

First of all, many of us would prefer that our computer speak in whole words rather than in individual letters. When you use the SPEAK command, though, you get individual letters. By buffering the incoming data and building a string variable from the individual letters, you can construct words. The program is designed to trigger speech when a space is received, since words are separated by spaces.

This procedure goes along fine until somebody starts sending something that isn't really a word. Abbreviations can be a big bugaboo. Comvoice will attempt to pronounce them as long as they contain no numbers or "illegal" punctuation. If they do, the program crashes.

The first addition I made to the program, therefore, was to add a subroutine to screen the data. When something other than a letter is received, the speaking part of the program simply ignores it, turning the characters into spaces. This keeps the program from crashing.

Next, the problem of callsigns had to be overcome with another subroutine. After all, it doesn't do much good if you can't figure out whom you are talking to. When the subroutine encounters a string that contains a number, the program automatically shifts into pronouncing each individual letter and number. This is done until another space is encountered, at which point normal word mode is reinstated.

My solution to dealing with the many abbreviations used in amateur transmission was to create a look-up table for the more common ones. This actually works quite well, but slows down the program. My list is by no means complete, but it can be expanded or changed to suit your own needs.

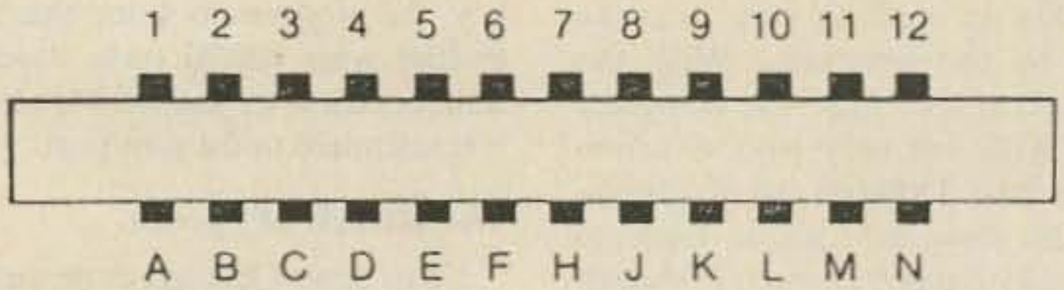
```
670 print x$;
680 if x$=chr$(13) then print#2,"h";:goto 620
690 if x$=chr$(10)then print#2,"b";:goto 620
700 if x$=chr$(32)then  print#2,"d";:goto 620
710 x=asc(x$)
720 if x<33 then goto 620
    print#2,x$+chr$(95);:goto 620
730 if x<65 then x=x-32:x$=chr$(91)+mid$(f1$,x,1):
740 if x>95 then goto 620
750 x=x-64:x$=mid$(l1$,x,1)
760 print#2,x$;
770 goto 620
780 if v=0 then return
790 if v=4 and c$<>" "then goto 810
800 if v=4 and c$=" " then v=1:return
810 if v=2 or v=4 then:if asc(c$)<48 or asc(c$)>90 then c$=" "
820 if v=2 or v=4  then:if asc(c$)>57 and asc(c$)<65 then c$=" "
830 if v=2 or v=4  then:speak c$:return
840 if asc(c$)>90 or asc(c$)<48 then c$=" "
850 if asc(c$)>47andasc(c$)<58then:gosub 1130:v=4:sa$="":speak c$:return
860 if asc(c$)>57 and asc(c$)<65 then c$=" "
870 sa$=sa$+c$:if c$=" "then gosub 920:goto890:if v=4 then v=1
880 return
890 speak sa$
900 sa$=""
910 return
920 if sa$="wx " then:sa$="whether"
930 if sa$="pse " then:sa$="please"
940 if sa$="rst " then:sa$="r s t"
950 if sa$="cul " then:sa$="see you later"
960 if sa$="qth " then:sa$="q t h"
970 if sa$="nw " then:sa$="now"
980 if sa$="qsl " then:sa$="q s l"
990 if sa$="qrn " then:sa$="q r n"
1000 if sa$="ok " then:sa$="o k"
1010 if sa$="qrm " then:sa$="q r m"
1020 if sa$="de " then:sa$="this is"
1030 if sa$="qsb " then:sa$="q s b"
1040 if sa$="mso " then:sa$="m s o"
1050 if sa$="ft " then:sa$="feet"
1060 if sa$="cq " then:sa$="c q"
1070 if sa$="khz " then:sa$="kilohertz"
1080 if sa$="b4 " then:sa$="before"
1090 if sa$="gn " then:sa$="good night"
1100 if sa$="gm " then:sa$="good morning"
1110 if sa$="qrt " then:sa$="q r t"
1120 return
1130 for b=1 to len(sa$)
1140 s$=mid$(sa$,b,1)
1150 speak s$
1160 next
1170 return
1180 rem ********************
1190 rem *   talking rtty   *
1200 rem *  copyright 1985 *
1210 rem *  by jim grubbs  *
1220 rem *   po box 3042   *
1230 rem *  springfield il *
1240 rem *    62708 usa    *
1250 rem ********************
```

Variations on a Theme

It is also possible to create a subroutine that scans for all strings three characters long that begin with "Q." This would enable the program to recognize Q signals and pronounce them correctly, and would work in a similar fashion to the callsign routine in lines 1130 through 1170.

In the final version, I decided that it would be nice to have both word and individual letter modes available. They are implemented using the function keys. The F7 key turns the voice on; F8 turns it off. A touch of the F5 key places the program into the individual character mode. For accuracy, any time the voice is turned on, the individual character mode echoes the transmitted data that the operator is keying in. F1 toggles the program between receive and send. You can change the unshift-on-space and speed options by pressing the back-arrow key, located in the upper left-hand corner of the keyboard, while in receive.

Under most operations (particularly at 60 wpm) with most typists, this Basic program has no trouble keeping up with what is going on. When full-tilt text is being sent by tape or from someone's buffer, the time involved for speaking will make the program lag behind the actual transmitted text. The Commodore has a built-in 256-character buffer, so until that overflows nothing will be lost. A more complex program could allow the in-



PIN #	TYPE	NOTE	PIN #	TYPE	NOTE
1	GND		A	GND	
2	+5V	100mA MAX.	B	CB1	
3	RESET		C	PB0	
4	JOY0		D	PB1	
5	JOY1		E	PB2	
6	JOY2		F	PB3	
7	LIGHT PEN		H	PB4	
8	CASSETTE SWITCH		J	PB5	
9	SERIAL ATN IN		K	PB6	
10	+9V	100mA MAX.	L	PB7	
11	+9V		M	CB2	
12	GND		N	GND	

Fig. 1. Connections to Commodore computer user port.

coming text to be buffered even further. I've tried the C-64 version of this program after compiling it using Blitz! and that helps overcome some of the speed problems. This may be the way to go if you want a long table of abbreviations.

Using Your Mind's Eye

It doesn't take much imagination to see a lot of other uses for a speech synthesizer in the blind ham's shack. With a bit of effort, a main program could be created to allow transmitter and receiver tuning by speaking the values. Once they have been tuned, you could select the desired mode. Even individuals with severe speech problems might be able to operate voice for the first time by typing comments on the keyboard and having the output of Comvoice directed to the transceiver. Think what will happen when speech recognition becomes available in the same price range!

I've even played with a program that could be used for contest operation, which has Comvoice calling CQ. You input the call of the answering station or the station you wish to answer. By pushing the right function keys, you can have the entire contest exchange spoken for you. Repeats and auto serial numbering are allowed for. The program contains a clock, so you can log the contacts from the same program. A dupe routine alerts you to stations you have worked before. I'm not quite sure how I would feel working a computer on Field Day or in the Sweepstakes, but the concept is fun anyway. Anybody want to see that one?

It's a Wrap!

The necessary connections to interface the computer to just about any standard terminal unit are included in Fig. 1. The program works equally well on both the VIC-20 and C-64, but keep in mind that it will work only with the Comvoice speech unit.

If you would like a copy of the program on disk or tape (be sure to specify which one), I'll be happy to supply one for $10. Send requests to QSKY Publishing, PO Box 3042, Springfield IL 62708. Sorry, time doesn't allow me to design individual programs or applications hardware. ■

Reference

1. The TDD system was invented by Bob Weitbrecht, a deaf amateur, using the Baudot code. For more information, refer to K9EI's article in TRANSACTOR magazine, volume 6, number 1.

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2500	15 MHz	(2)	3.5 inch	2 mV per div	30 MHz	25 MHz
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CT-50 8 DIGIT 600 MHz

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$189.95 WIRED INCLUDES AC ADAPTER

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CT-70	20 Hz-550 MHz	< 50mv To 150 MHz	1 PPM	7	1Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100 mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.90

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There is little doubt that the microelectronics revolution has had a profound effect on CW. First came simple keyers, followed by memory keyers, keyboards, code readers, and now full-function Morse terminals. Although many fine CW/RTTY terminals are available, a microcomputer-based system is attractive in that the computer can be used for many other purposes as well, helping to justify the cost of the system.

Vendors such as AEA and Kantronics offer a full line of software and hardware interfaces that will provide full CW/RTTY operation with a variety of home computers, including those made by Tandy, Apple, Commodore, Atari, and IBM. Assuming you have the computer on hand, you can be off and running for less than $250 for the software and the interface unit.

You can always trust the dedicated ham to try to cut corners, so I sat back waiting for some magazine to publish a suitable software article for operation with my Color Computer. Along came a program in the December, 1982, issue of *80 Micro* by Michael Chuck. This is a full-feature package for the CoCo, offering speed autotrack on receive, keyboard-select of transmit speed, multiple memory buffers, and provisions for machine storage of contact data—in short, almost anything you might need in a CW terminal.

About the only thing missing from Mike's fine article was a decent interface circuit. The design presented was a simple audio-operated switch sufficient to demonstrate the potential of the program, but too deficient for serious operation on the HF bands.

Anxious to put the program to work in my New Year's quest for WAS using QRP, I set out to design a general-purpose interface unit that could be used with any software/computer system and that would work with almost any HF equipment. The project was reasonably successful and along the way I learned quite a bit about machine-processed CW! The purpose of this article is to pass along some of these observations as well as a simple but practical interface design.

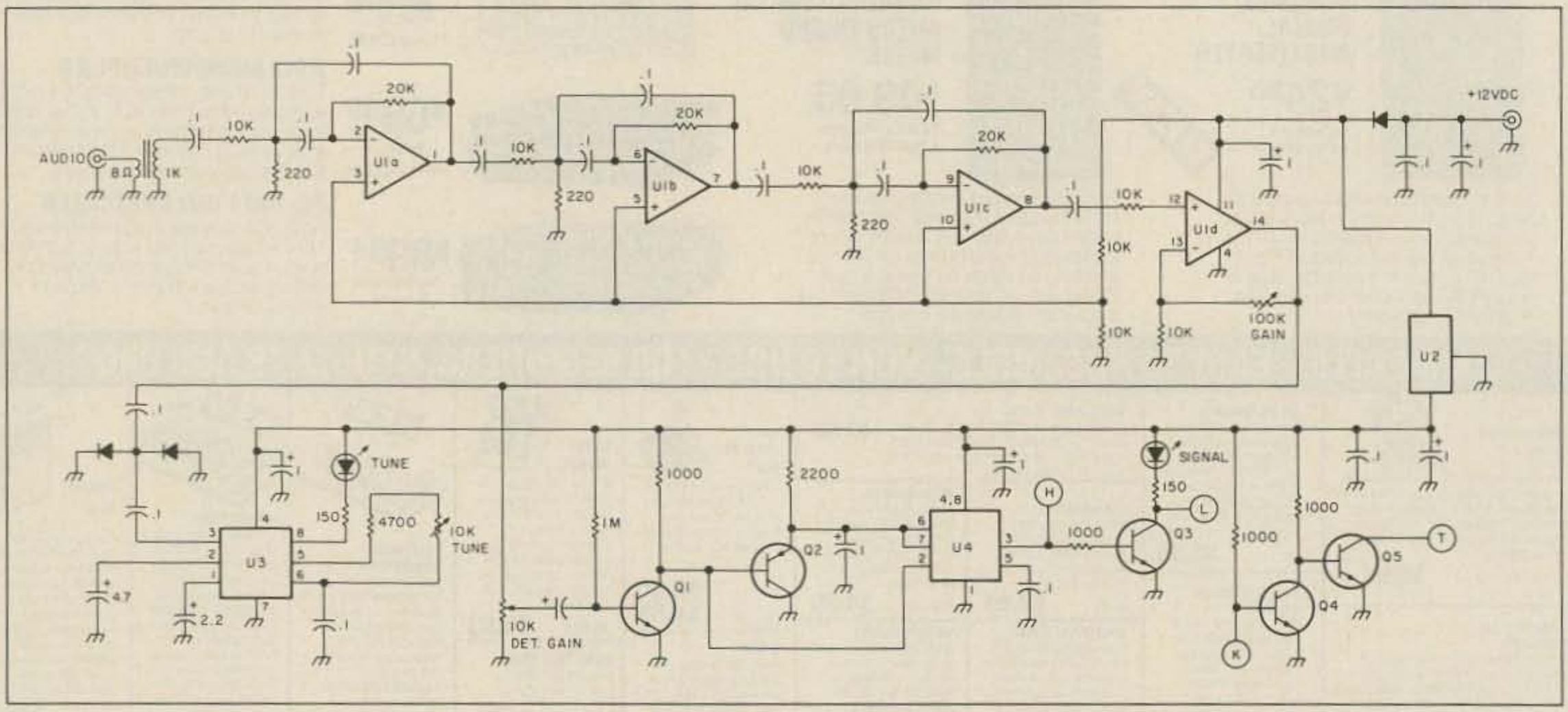


Fig. 1. Schematic diagram of the CW/computer interface. U1 is an LM-324N quad op amp, U2 is a 7805 (LM340T-5) voltage regulator, U3 is an NE567 tone decoder, and U4 is an NE555V timer chip. Q1, Q3, Q4, and Q5 are general-purpose NPN transistors such as the 2N4401, while Q2 is a general-purpose PNP (2N4403 or equivalent). Unmarked diodes are general-purpose silicon (1N4004), while the indicator LEDs can be virtually any LED. All resistors are 1/4 W, 5% composition. The 100k gain pot is a standard panel-mounting pot (linear taper), while the detector gain pot is a PC-mounted linear trimmer. All capacitors are in uF; non-polarized units are mylar™, while polarized units are dipped tantalums (16 V minimum). The input transformer is a subminiature 1k. An 8-Ohm unit is available off the rack at Radio Shack.

Design Considerations

The attributes of the ideal CW interface are easy to define. The unit should be compatible with all code speeds up to blue light, capable of decoding signals at or below the noise level, and immune to QRM! Unfortunately, a reasonably simple interface circuit cannot be expected to have all of these sterling features. What you will get with a reasonable parts count is as follows:

•The unit is capable of copy at extremely high speeds—certainly up to 60 wpm. I know it will deliver good copy at speeds where letters are virtually indistinguishable and even where word groups are difficult to discern.

•The performance in noise depends on the type of noise you must contend with. A relatively constant white-noise level is no problem, but loud static bursts or pulse-type noise will cause copy errors if the signal-to-noise ratio is unfavorable.

•With SSB receiving filters, the interface is highly effective in the presence of even heavy QRM as long as it doesn't desense the receiver to the point where the desired signal drops out. With CW i-f filters, I would say the interface is almost uncrunchable, delivering solid copy at the low end of 20 in the midst of a contest!

Although the receiving side of any interface circuit is by far the most critical, the transmitting side has not been neglected in this design. Most CW transmit routines for home computers use the cassette recorder motor-control relay for CW keying. If your rig has a solid-state keying-control circuit, this will present few problems. You can put some mileage on the relay if you try to key higher currents or voltages. The interface incorporates a keying-control circuit to minimize relay wear. Provisions are included for keying the transmitter with either a transistor switch or a small relay.

All of the various circuit ideas incorporated into the interface will be described fairly completely. This is not to make the circuit easier to duplicate—you could really do that knowing very little about how it works—but rather to give you some ideas for your own experiments if you want to start playing with interface hardware options.

It is a deceptively simple subject that quickly deepens once you start to play with real-world trade-offs. Finding out why some ideas don't work or why others work very well can be a fascinating pastime that doesn't consume a lot of money or require hard-to-get parts. Follow along and see how I did it, and then take off on your own if you are so inclined! The complete interface schematic in Fig. 1 will serve as the primary reference for the sections that follow.

Audio Filters

The first question that might be asked is why bother with audio filters? If your rig incorporates narrow CW i-f filtering, extensive audio filtering will not make a major difference in performance—though it will help a bit.

Unfortunately, virtually all of the high-class transceivers on the market, while sporting excellent SSB filters, always have the CW filter as an "option." Since the option costs money, all too many operators end up using SSB filters with Morse and then wonder why it is not as much fun as the dedicated CW friends say it is. In such cases, some effective audio filtering can make CW a pleasure.

At the far end of the scale in receiver design are the direct-conversion jobs that have appeared over the years as companions to QRP rigs. Although CW is the primary mode, to judge by the companion transmitters, these receivers tend to have only SSB-bandwidth audio filtering and desperately need all the CW filtering they can get.

One of the simplest approaches to audio filtering is the multiple-feedback, active-bandpass filter (illustrated in Fig. 2). Here, a single op-amp stage can be wired as an audio-bandpass filter with a defined set of characteristics.

Assuming a constant value for the capacitors in the filter circuit (C), filter performance is set by three resistors. The input resistor (R1) sets the stage gain, the shunt resistor (R2) sets the center frequency of the filter, and the feedback resistor (R3) sets the bandwidth. The design formulas for these resistors are shown along with the diagram in Fig. 2.

The design of a suitable filter stage involves selecting appropriate performance parameters and calculating the resistor values for the filter. That is simple enough, so what do we want as performance targets in terms of center frequency, bandwidth, and gain?

Ideally, the filter center frequency should match the peak audio output of the receiver in the CW mode, which in turn should correspond to the proper receiver offset for transmitter zero beat. In most modern gear this is about 750 Hz.

Bandwidth is a more complicated problem. Narrow bandwidths, short of the point where excessive ringing is produced, can minimize QRM but can also present a number of problems. Since the bandwidth required by a CW signal is related to keying speed, a very tight filter system will impose limits on the upper end of your received speed range. Very narrow filters also can make receiver tuning very critical and can be tedious if either the receiver or transmitter has a small amount of drift.

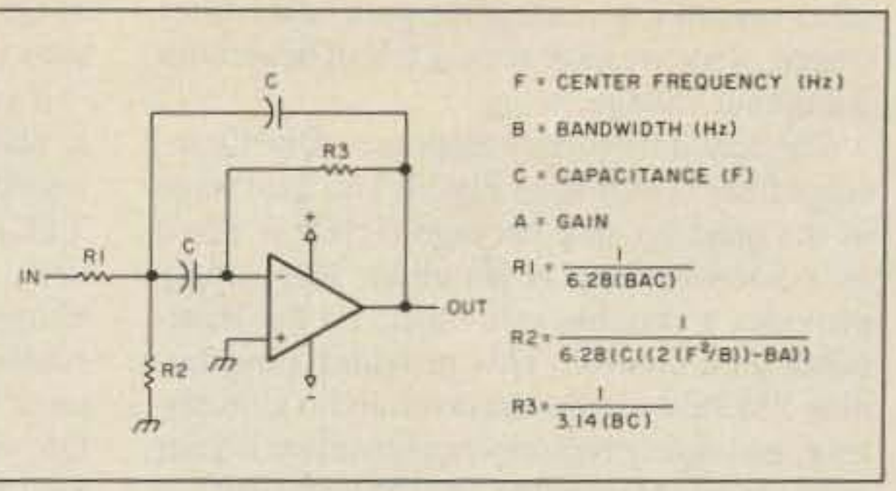


Fig. 2. Layout and design equations for a single-stage active-bandpass filter. Three such stages are used in the interface circuit.

Photo A. The author's HF station, the mighty Argonaut 515 QRP transceiver and the Radio Shack Color Computer. The CW interface is perched on top of the Argonaut. For the benefit of those who think that QRP is just for playing games, I resolved to work all states during the new year, even though I have time to get on only a few hours a week. That little Argonaut is my only HF rig, but you could never tell by looking at the log!

A bandwidth of approximately 150 Hz is a reasonable compromise, permitting keying in excess of 50 wpm, a very significant selectivity increase (yet not being overly fussy in terms of tuning and stability). The Q of a single filter stage of the type illustrated in Fig. 2 is not outstanding, but several stages can be cascaded to develop the desired aggregate filter response.

Gain in an active filter stage can be almost anything desired, but caution must be exercised so that excessive gain does not cause an overload of any detectors in the system. A target gain of 1 was chosen since plenty of signal is normally available from the receiver audio system.

The value for C is somewhat arbitrary, and for audio work either 0.1 or 0.01 uF is usually chosen for convenience. Since the center frequency is fairly low, let's use 0.1 uF for starters. If the filter parameters are plugged into the design equations of Fig. 2, we get the following:

Center Frequency	750 Hz
Bandwidth	150 Hz
Gain	1
R1 (input)	10,610 Ohms
R2 (shunt)	216 Ohms
R3 (feedback)	21,220 Ohms

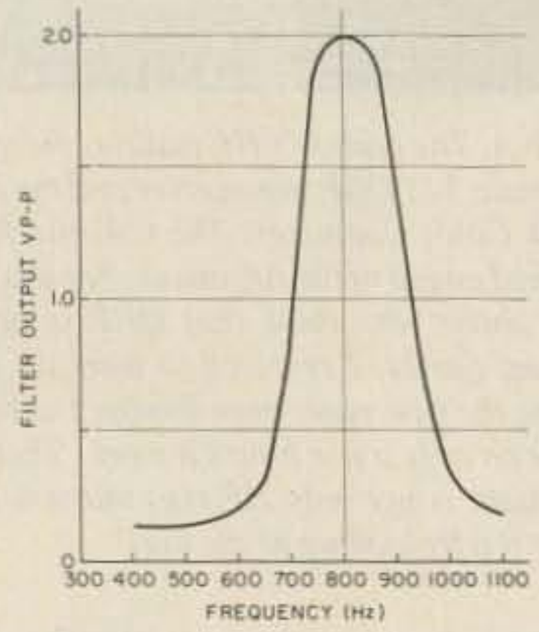
These are not exactly standard values, and rather than use multiple resistors in series/parallel to achieve precisely these values, you can rearrange the equations of Fig. 2 to see the effect on performance of substituting the nearest standard 5% resistor values:

R1	10,000 Ohms
R2	220 Ohms
R3	20,000 Ohms
Center Frequency	767 Hz
Bandwidth	159 Hz
Gain	1

Since our original parameters were seat-of-the-pants figures to begin with, the actual performance to be expected when standard values are used is quite acceptable.

The filter section of the actual interface (Fig. 1) consists of three identical stages (U1A–U1C) using these resistor values. The only departure from the general circuit in Fig. 2 concerns the biasing of each stage. For convenience, we want to use a single-ended power supply, so I biased the + input of each stage to +6 V with a voltage divider to ensure distortion-free ac amplification. This is another reason for limiting the gain of the filter stages, since we have only ±6 V of headroom for output voltage swing.

The actual frequency response of the three-stage filter is plotted in Fig. 3. The final stage of the quad op-amp package (U1D) is wired as a non-inverting ac amplifier that simply provides a variable gain block via the front-panel gain control. This provides considerable flexibility in the receiver audio gain setting, and rarely requires readjustment if your receiver has reasonable agc characteristics.



Frequency (Hz)	Output (VP-P)
400	0.15
450	0.15
500	0.15
550	0.20
600	0.20
625	0.25
650	0.30
675	0.55
700	0.80
725	1.30
750	1.80
775	1.95
800	2.00
825	2.00
850	1.95
875	1.85
900	1.45
925	1.05
950	0.75
975	0.55
1000	0.35
1025	0.25
1050	0.25
1075	0.20
1100	0.20

Fig. 3. Measured frequency response of the three-stage active filter used in the interface. The filter characteristics were determined using a commercial function generator as the signal source with an oscilloscope to measure the filter output voltage. The center frequency with the resistors used should have been approximately 770 Hz and the design bandwidth was 150 Hz. The measured center frequency was 812 Hz and the actual filter bandwidth at the-3-dB points was 220 Hz. This performance is entirely acceptable when standard resistor and capacitor values are used. The graph plots the data.

Tuning Indicator

Since we are using a sharp audio filter, a tuning indicator will ensure that your equipment is tuned precisely to the center of the filter bandpass and that it is properly tuned for zero beat. The popular NE567 tone decoder (U3) handles this job. This IC is driven at pin 3 by a sample of the filter output and is set to 750 Hz by the tune control. When a 750-Hz tone is present, indicating that the received signal has been properly tuned, pin 8 of U3 will pull low, lighting the tune LED on the front panel.

Keying Detector

The output of the filter also drives the keying detector, which consists of Q1, Q2, U4, and Q3. With sufficient drive from the filter network (dependent on the setting of the detector gain pot), Q1 will be turned on by audio signal peaks, thus causing its collector to pull low. The low at Q1's collector triggers a missing pulse detector composed of Q2 and U4. Timeout for U4 is adjusted so that the output of U4 (pin 3) will remain high when Q2 is triggered and will not transition low until several cycles of 750-Hz audio have passed. The output of U4 will thus follow the input keying, but it will not respond to the beat-note ac waveform.

Essentially, the missing pulse network can be considered a digital detector that eliminates the need for software filtering of the signal waveform. The high from U4 drives Q3, which causes the signal LED to be on whenever a detected waveform is present. If your software routine requires a TTL high to indicate keying, the connection should be made to point H. Alternatively, software that requires a low for beat-note recognition will require a connection to point L.

Keying Control

As noted earlier, most CW software keys the cassette control relay in transmit. A two-transistor keying-control circuit consisting of Q4 and Q5 is used to provide a universal interface between the cassette relay and the transmitter keying circuit. The relay contacts are normally connected between point K and ground. Q4 is normally biased on, causing the collector of Q5 to remain high. If the cassette relay closes, however, Q4 goes off and causes the collector of Q5 to pull low.

The transmitter keying circuit can be connected to point T if a solid-state keying circuit is used in the transmitter. If you are directly keying a tube-type transmitter, you may wish to use a reed relay and diode in the collector of Q5, and connect the transmitter-key contacts to the reed-relay contacts.

If your software routine produces TTL logic shifts at a port during transmit, you can interface to the keying circuit very easily. If a TTL low is produced during key-down intervals, connect the port to the base of Q4 and eliminate the 1k resistor at this point. If the routine uses a TTL high for key-down, then omit Q4 and associated resistors and drive Q5 with the output of the port dedicated to keying.

Power Supply

For the prototype, the required 12 V was obtained from the transceiver power supply. If this is not convenient, a separate 12-V supply can be included. The +5-V circuits are powered from the 12-V bus by means of an IC regulator (U2). Note that liberal bypassing has been incorporated throughout, including a 1-uF tantalum at the Vcc bus to each IC. This bypassing was found to be essential for stable operation.

Construction

The basic circuit can be wired with perfboard or one of the many prototyping boards that are available. Lead lengths around the filter stages and amplifier in U1 should be kept as short as possible. Layout around the other devices is noncritical.

As shown in Photo A, the prototype was housed in one of those readily available plastic instrument enclosures. I find that these are a pain to use: You must run ground leads everywhere since the case and panels are plastic, and the case itself doesn't provide any shielding. The cases do look good, however, and no trouble was encountered with this circuit application. Minimal front-panel controls include the gain control and the tune and signal LED indicators. No on/off switch or power indicator was included since the prototype was powered from the transceiver and is on whenever the transceiver is powered up.

The complexity of the rear apron will depend on the interfacing requirements for your hardware/software package. The interfacing for the Color Computer using the Chuck program involves a 5-pin DIN connector socket for the cable from the computer cassette port and a 4-pin DIN plug for the RS-232 port. Standard off-the-shelf cables from Radio Shack are used to interconnect the computer and interface unit. Your own system interface will govern the type of connectors needed for computer hookup.

In addition to the computer connectors, you will need a phono jack for the receiver audio line, another for the +12 V, and a third for the connection to the keyed line of the transmitter. Standard shielded audio cables with phone plugs can be used for the interconnections between the interface and the rig. If you are going to tap into the receiver audio at the headphones jack, you will need a 1/4" phone plug at the transceiver/receiver end of the cable.

The headphones jack on most rigs is wired to silence the speaker when a phone plug is inserted. You can rewire the plug to defeat

this function, install a small speaker in the interface, or install an additional audio jack in parallel with the audio input and connect an external speaker to this jack. Since I rarely use phones, I opted to rewire the rig, but one of the latter two options is better if you use phones and want to retain the speaker blanking when earphones are employed.

Checkout

Tuning of the interface will require some means of measuring ac voltage. A scope is ideal, but an ac voltmeter that will let you measure signals of a few volts accurately will do. An analog meter (heaven forbid!) is preferable to a digital meter in this application.

Connect the scope or meter to the output of U1D through a small coupling capacitor (0.1 uF will do). Set the receiver audio gain for normal speaker level and tune across the signal from a crystal calibrator or some other stable source. A clean birdie will do the job if it is reasonably strong. Choose a dead band for this procedure, as we don't want tuning to be confounded by other signals.

Set the interface gain control to mid-range and carefully tune the receiver for maximum signal indication on the scope or meter. Now, adjust the tune control of the NE567 tone decoder until the tune LED lights. Reduce the interface gain and readjust the tune control as indicated above. Our goal is to adjust the tune control so that the tune LED will operate with the lowest possible signal level.

Return the gain control to mid-range and adjust the detector gain pot until the signal LED comes on. If this control is properly adjusted, the signal indicator will start to light just prior to the tune indicator as you carefully tune across the signal source. If the signal response is much broader than the tune response, reduce the detector gain. If it is narrower, increase the detector gain slightly. Making the signal response slightly broader than the tune response will let you hold the signal for a bit if the other station (or your receiver) is drifting slightly. The tune indicator, failing to respond to the signal, will alert you to the need for slight retuning.

Grounding point K (or applying the appropriate logic signal in the case of software that keys from an I/O port) should key the transmitter.

Operation

If you load and run your software at this point, you should be in business. Simply tune across the signal of interest until the tune indicator is solidly flashing in response to the keying. Both the tune and signal indicators should be merrily flashing away at this point, and received CW should be appearing on your video monitor. If you switch to the transmit routine, you should be keying the transmitter from the keyboard.

QRM will usually be rejected by the interface if it is more than 100–150 Hz away from the desired signal. Very strong QRM might, however, capture your receiver agc and cause the desired signal to drop down to the point where the tune and/or signal indicators become erratic. This is usually a problem only when the desired signal is quite weak relative to the QRM. Unless the offending signal is very close to the frequency, you can usually increase the gain to the point where the desired signal is readable without interference.

Noise effects come in two varieties. On the higher frequencies, the noise is usually quite consistent in level and will cause little difficulty as long as the signal-to-noise ratio is reasonable. Static crashes are another matter, as they can have a high but short-term amplitude. I generally try to adjust the receiver rf gain and the interface gain so that the signal indicator ignores all but the worst bursts, providing pretty clean copy if the desired signal level is reasonable. You will have to face the fact that no interface or software routine will give solid copy with a QRP or weak DX signal on 40 and 80 when there is heavy QRN.

The interface will provide solid copy in excess of 50 wpm, which is right in line with the bandwidth of the signal filters. Accurate assessment of the speed performance of your software is best determined using the W1AW code practice runs: W1AW usually puts in a strong signal and the code is machine-generated.

It will not take you long to realize that, with the exception of some really good CW operators, the best copy comes from operators using keyboards. When sending at high speed, most ops using a keyer or hand key will begin to get erratic with their spacing and character formation. It is disconcerting to tune across a high-speed CW signal and read:

T5E X YL HAW T5I NE W RSG

when a keyboard would have delivered the more legible:

THE XYL SAW THE NEW RIG

All in all, I think you will find the interface circuit highly satisfactory for most operating situations. It also will provide the basis for some simple circuit experimentation if you want to design that elusive perfect interface.

Machine-generated CW has the benefit of sounding good regardless of your manual keying skills, but you must type reasonably accurately. Machine-read CW is fun and provides visitors to the shack with a means to follow your contacts. I think my wife now believes that CW operators are real people! Just remember not to get in over your head in terms of operating speed. You will always run into situations where the machine copy will drop out and you will have to carry the mail with your own built-in CW processor! I get a kick out of being able to hang in there when the machine has to quit. If you lose, or worse yet, fail to acquire that skill, your computer may be a CW operator, but you are not!

So warm up the soldering iron and get the computer on the air. If you operate QRP as I do, you will have the distinction of operating a station where the keyer consumes more power than the rig! It may not seem sensible, but it is a lot of fun! ■

Guy Slaughter K9AZG
753 W. Elizabeth Drive
Crown Point IN 46307

You, Too, Can Be An SOB

K9AZG thinks that hams should be heard but not seen—put your left hand on the Callbook *and repeat after me . . .*

Number 6 on your Feedback card

As president and organizer of a new fraternity aimed at recapturing the traditional policies of hamming, I invite those few remaining radio amateurs who shun personal contact with other hams to join an international net known as the "Solitary Operators' Brotherhood."

We are not to be confused, however, with chronic QRMers sometimes referred to by our initials. When you hear an irate operator saying, "Sorry, Charlie, I missed your QTH on account of them SOBs was tunin' up on you again," the chances are he is not referring to one of us.

We legitimate SOBs, whether or not we use dummy loads, have banded together to preserve and perhaps rebuild what has become a dying subculture among amateurs. We offer an alternative to hamfests and club meetings and picnics and eyeball get-togethers of all kinds, because we share one fierce conviction: We believe in communicating with our fellow hams, but not in mingling with the buggers.

Hamming is for chatting from a distance, we think. It is for exchanging thoughts, ideas, information—even for sharing emotions—with strangers out there in Radio Land whom we cannot see and by whom we cannot be seen.

Because they are invisible to us, we perceive those we contact as perfect creatures, handsome, wholesome, witty, wise, paragons of beauty, knowledge, and virtue. And because we are invisible to them, we can assume their perceptions of us are equally inaccurate.

This pleasant state of affairs exists, of course, only for as long as we avoid physical contact with each other. It instantly evaporates if and when we visit each others' shacks or eyeball each other at club meetings, hamfests, banquets, flea markets, or any of the myriad of similar illusion-destroying social events at which non-SOBs congregate. For who can deny that to meet a fellow ham—any fellow ham, every fellow ham, however delightful his/her voice, whatever the perfection of his/her on-the-air manners—is to be disillusioned, to discover that he/she is, like the rest of us, a scruffy mortal with a runny nose, rumpled clothes, and scratches on his/her gear.

Despite this obvious truth, the tendency among most radio amateurs today is to socialize, to congregate, to mingle. And that is fine for those who so enjoy the emotional reinforcement of flocking together with birds of like feather—they don't mind the disillusionment it inevitably brings.

But the Solitary Operators' Brotherhood was organized for those of us who think it more appropriate to emulate the pioneers of our hobby. Those giants of spark and coherer or cat-whisker days sat alone in attic and basement, history tells us, tinkering up QSOs with other weirdos in other garrets and other cellars, blocks and even miles away. That was the golden age, as we SOBs see it, the era of hermit hams, of non-gregarious gadgeteers, of antisocial pseudo-scientists who loved their Leyden jars and revered their variocouplers, but hated interruptions and despised company.

> ***"We believe in communicating with our fellow hams, but not in mingling with the buggers."***

Today, we of the Solitary Operators' Brotherhood have readopted that ethic. We contend that, while other hams have interests akin to ours, all hams are strange by definition, some even stranger than we. We feel very strongly, therefore, that hams should never congregate in groups larger than one, lest the enormity of our cumulative strangeness become apparent to others or, worse, obvious to ourselves.

The SOB constitution, therefore, requires members to avoid face-to-face meetings with other amateurs. This is our only caveat, though SSTV and FSTV operators are obviously ineligible. There are no initiation fees, no dues, and above all, no meetings to attend. In fact, if any SOB goes to any kind of amateur social affair anywhere, he is subject to instant expulsion. And so compliant with this rule are we that none of us ever has been expelled. "Once an SOB, always an SOB" is our motto.

So how do you join?

Membership is by over-the-air invitation only. Any amateur holding any class of license anywhere in the world is welcomed (SSTV and FSTV ops aside) so long as he swears on the memories of Hertz, Steinmetz, Phelps, and The Old Man himself to abide by the no-meetings rule.

(Phelps, Herman W., ex-1XGZ, for the benefit of those who may not be thoroughly schooled in early amateur lore, was the first licensed ham operator to fracture his skull on an attic rafter while jerking his lip away from an rf arc drawn off a carbon microphone loop-modulating a self-excited 210 on or near 160 meters.)

To join, find a member to sponsor you, vow to avoid personal meetings with other hams (unless you have some in your immediate family; the rules allow limited contact with licensed kin). If he agrees to be your SOB-father, you are in.

So how do you find us?

Just start asking each of your contacts hereafter—on phone, CW, or RTTY and on whatever band—if he is an SOB. Nonmembers usually will deny it. Now and then you may even run across a guy who'll mutter nasty comments about you and break off the QSO. But sooner or later you will run across a real member of the Solitary Operators' Brotherhood eager to make you one as well.

"Welcome aboard, you SOB," he'll tell you. "Now you are one of us."

And then you will know you have become a real SOB, pledged to carry on the almost-forgotten tradition of the old-timers who labored alone to contrive their magical visits with others out there, unseen, unmet, unrecognized for what they were and what we are today—scruffy humans with runny noses, rumpled clothes, and scratches on our gear. ■

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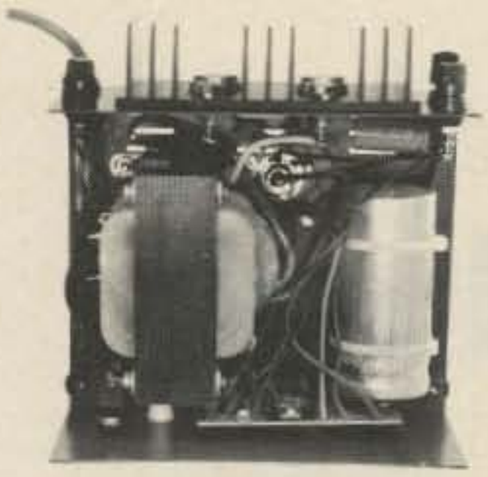

INSIDE VIEW – RS-12A

RS and VS SERIES

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output.
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-4A.
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage.
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105 - 125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE: Less than 5mv peak to peak (full load & low line)

MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

RM-A Series

MODEL RM-35A

19" X 5¼ RACK MOUNT POWER SUPPLIES

Model	Continuous Duty (AMPS)	ICS* (AMPS)	Size (IN) HXWXD	Shipping Wt. (lbs.)
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• SEPARATE VOLT & AMP METERS				
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W X D	Shipping Wt (lbs)
RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

RS-M SERIES

MODEL RS-35M

- Switchable volt and Amp meter

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

VS-M SERIES

MODEL VS-20M

- Seperate Volt and Amp Meters
- Output Voltage adjustable from 2-15 volts
- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7S	5	7	4 x 7½ x 10¾	10
RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

Paul M. Danzer N1II
2 Dawn Road
Norwalk CT 06851

Tap, Tap, Tap, Clunk

Splice an ASR-33 to your VIC-20 for RTTY hard copy—you won't believe how much paper you'll need!

Number 7 on your Feedback card

There are very few true bargains in the ham world these days, but certainly the VIC-20 is one of them. You can get the computer inexpensively, and by adding a small commercial software package you can quickly be on the air with all speeds of RTTY and ASCII. An additional bargain is a used ASR-33 (or similar ASCII keyboard/printer combination), which has an expected life that probably exceeds your own.

As a long-time ham and bargain hunter, I couldn't resist either of these two units. The VIC-20, combined with a general-coverage receiver, allowed me to read the news-service transmissions from agencies all over the world. After a few weeks of this, it was time to attach my other toy, the ASR-33, and get hard copy.

The only problem was that the two would not work together. The VIC-20, equipped with commercial ham software, provides a parallel output at the user port, and the ASR-33 is a serial machine. While the VIC-20 has a serial output port, the software drives only the parallel port.

"Somewhere in the depths of Teletype Corporation there is a document that tells how the standard modules making up your machine were wired."

Block Diagram

The solution was to run down to Radio Shack and pick up a little beast called a universal asynchronous receiver/transmitter (UART), which is specifically designed to convert parallel ASCII to serial or serial to parallel. It is contained in a 40-pin package and runs from a single 5-volt power supply.

The block diagram in Fig. 1 shows the UART as IC2, with eight parallel data bits and a data strobe coming from the VIC-20. IC1 is a 555 set up as a clock oscillator with a frequency of 16 times the baud rate of the serial output. Since the ASR-33 is a 110-baud machine, the clock was set to 1760 Hz.

You could question if IC4 is needed at all. It is a 7400 chip wired to put two gates in series as a non-inverting buffer amplifier. While I don't doubt that the UART could drive a few feet of wire to the ASR-33 without buffering, I would rather blow up an 89¢ microcircuit such as the 7400 than the $6 UART if the lead shorted to some unlikely place.

The remaining microcircuit, IC3, is another 555 used as a one-shot attempt to fool the VIC-20 and tell it that the UART is ready for more data. Why I had to do this rather than use the real acknowledge pulse is explained toward the end of this article.

Circuit and Layout

Fig. 2 is a combination circuit diagram and layout. The four microcircuits are shown in a line mounted on a Radio Shack Experimenters PC Board. The horizontal lines labeled "bus X" and "bus Y" correspond to the bus layout on the board. The top bus is connected to +5 volts from the VIC and the bottom one to ground.

A two-foot length of ribbon cable is used to connect the computer to this board. The rib-

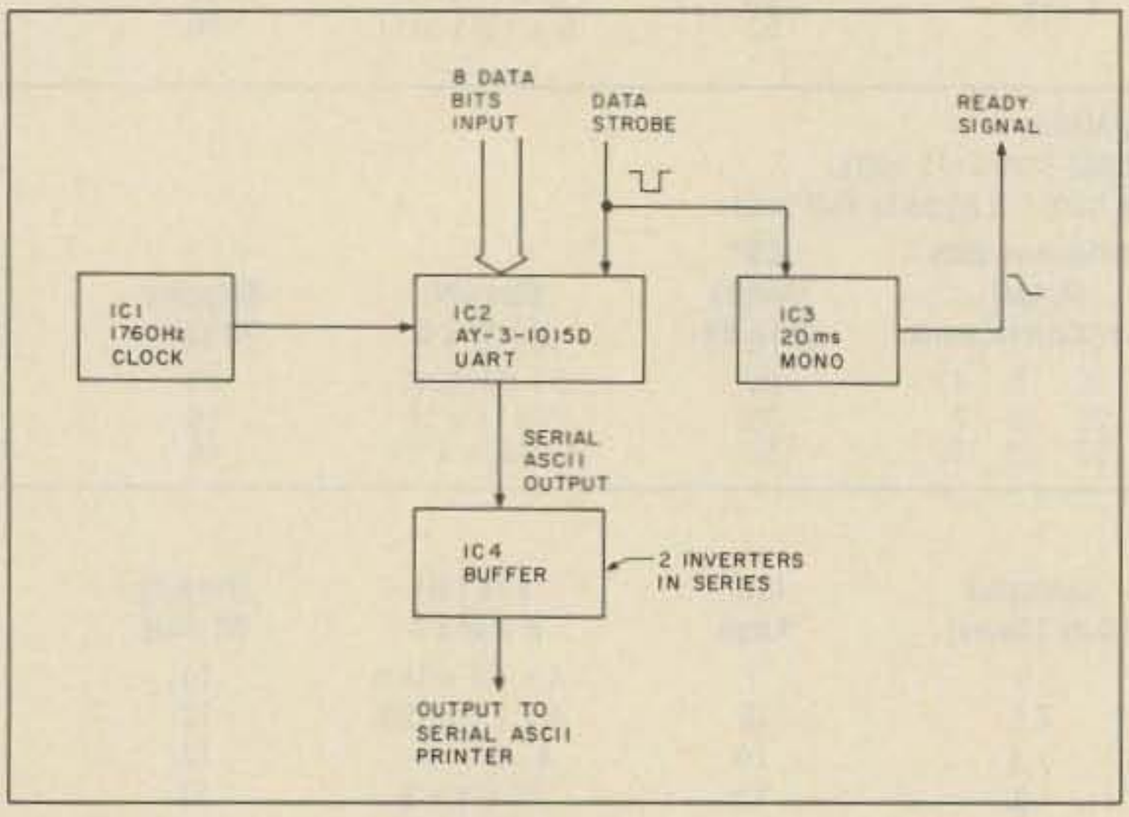

Fig. 1. Block diagram.

Parts List

IC1, IC3 — 555
IC2 — AY-3-1015D
IC4 — 7400
R1 — 50k pot
R2 — 33k, ¼ Watt
R3 — 20k, ¼ Watt
R4 — 470k, ¼ Watt
C1 — 10 μF, 50 volt
C2 — .01 μF, 50 volt
C3 — .01 μF, 50 volt
C4 — .05 μF, 50 volt
C5 — .01 μF, 50 volt

IC sockets, 40-pin, 14-pin, and two 8-pin, PC board (Radio Shack 276-170), connector (RS 276-1551), and ribbon cable (RS 278-772).

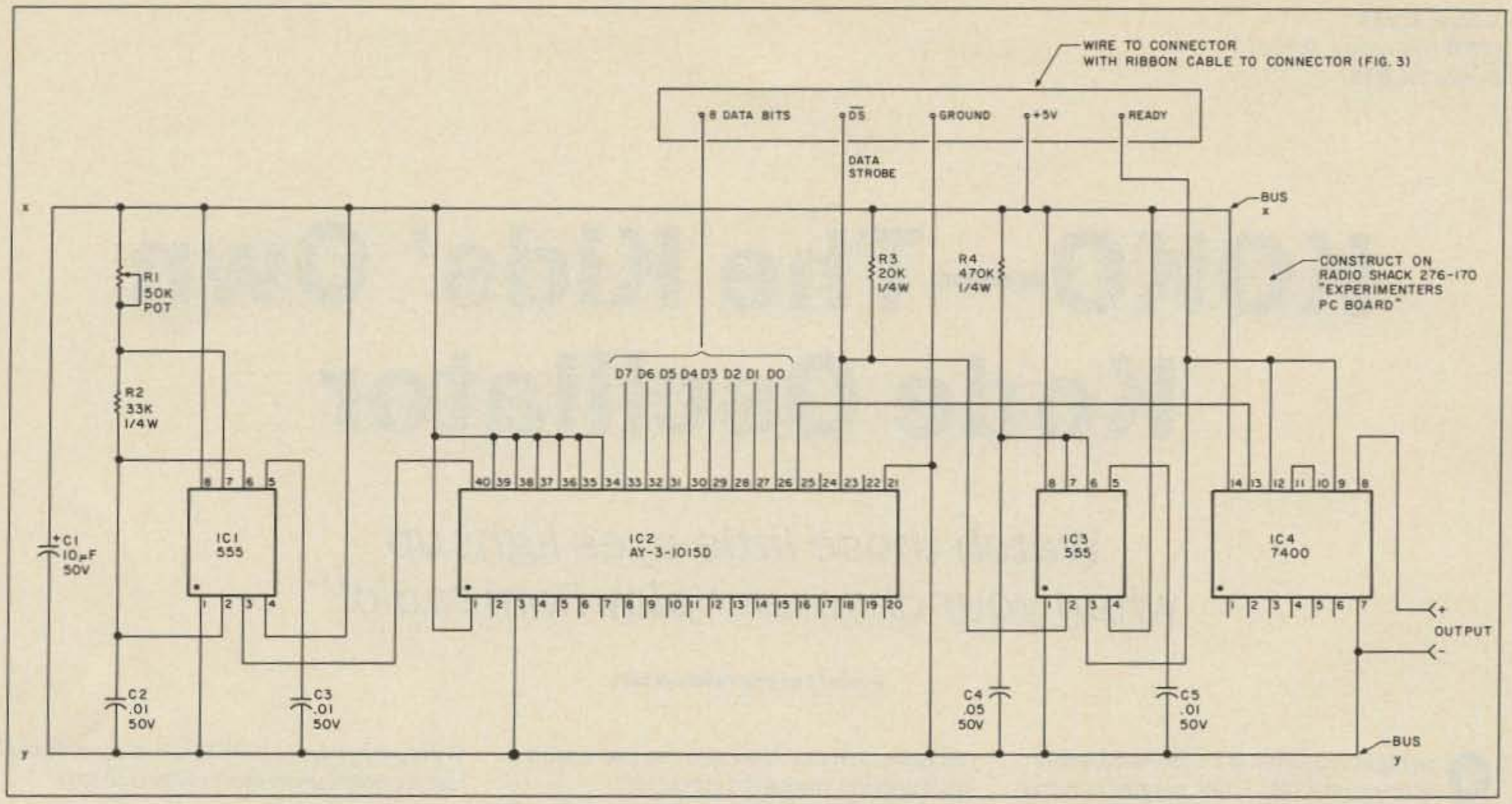

Fig. 2. Schematic and layout.

bon cable passes over the part of the board outlined at the top of the layout, and a small piece of plastic corresponding to the outline is screwed to the board to hold the ribbon cable in place.

R1 is used to set the clock frequency to 1760 Hz. I would suggest looking for a multi-turn pot, although the setting is not all that critical. R2 is a fixed resistor and offers no problems. C2, which is the third part of the frequency-setting circuit, should be a polystyrene cap (Radio Shack 272-110) rather than one of the usual disc-ceramic units.

Assuming no other problems, you can just build up the unit, connect it, and adjust R1 until the ASR-33 starts to print real words rather than garbage. However, the easiest way to set the frequency is by connecting a frequency counter bewteen pin 3 and ground and adjusting R1 for a reading of 1760.

Input and Output Connections

A rear view of the needed 24-pin connector is shown in Fig. 3. Yes, needed but not found. Not to worry, however; good old Radio Shack to the rescue. They offer a 44-pin connector (number 276-1551). With your trusty hacksaw, cut off a section containing 24 pins (two rows of 12) and you have it made. Just be careful to line up the uncut end of the connector with the VIC connector at the back of the VIC-20 so all pins will meet. I would also suggest connecting and disconnecting the circuit only when the power is off.

Connections to the ASR-33

I happen to own an old ASR-33, but all of the following comments apply to any of the 32, 33, and other series that have a printer function. Each of these machines is wired differently for each customer and, presumably, somewhere in the depths of Teletype Corporation there is a document that tells how the standard modules making up your machine were wired.

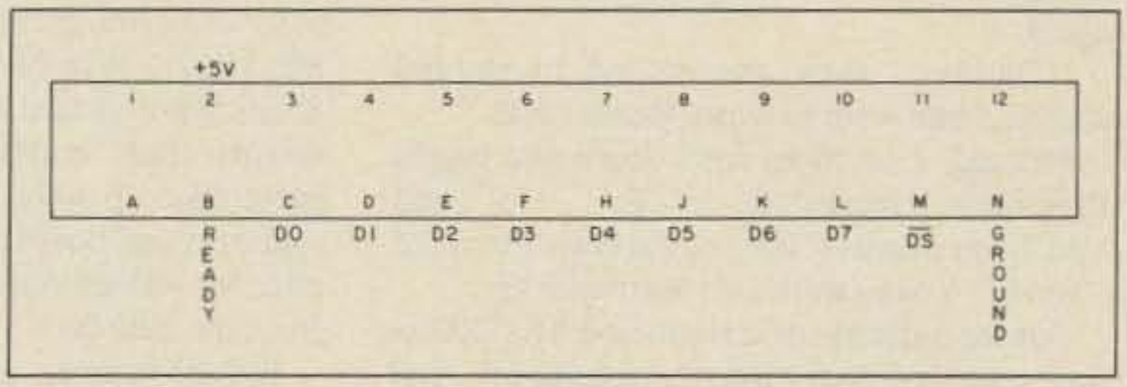

Fig. 3. Rear-view connector to VIC-20 user I/O port.

I took mine apart and, of course, couldn't figure it out. However, I did manage to find the power supply, which is wired in series with the printer. I broke one of the leads, inserted an electro-optical coupler (watch the polarity), and drove the input with a 5-volt signal through a 330-Ohm resistor. It worked for me and probably will work for you.

Incidentally, by increasing the resistor to account for the higher voltage in a standard serial RS-232 line, I hooked the printer to my Apple and now have a backup printer.

If You Have Problems

The only tricky part of the circuit is the READY or ACKNOWLEDGE pulse, which must be fed back to the VIC to tell it that the UART is ready to receive the next character. The UART has an output just for this purpose; it's called Transmitter Buffer Empty (TBMT). Unfortunately, this signal occurs one or two clock pulses after the VIC sends the data-ready pulse, or a maximum of around one millisecond.

The commercial software is set up to look for a one-to-zero (+5 to ground) transition as the ready signal, but the software is relatively slow and the TBMT occurs before the software is looking for it. Therefore, IC4 is set as a one-shot attempt to produce a one-to-zero transition 10 to 20 milliseconds after the data strobe, when the software is looking for it. The trick works for all Baudot speeds and for ASCII up to 110 baud.

It is possible that your software was written to look for a positive level as the ready signal, in which case the one-shot technique will still work. However, if it is perversely written to look for a zero or ground signal, there are two spare inverters left on IC4. Just connect the output of IC3 (pin 3) to pin 1 of IC4 and take the zero output on pin 3 of IC4.

If you are really a purist or one of those people who like to get rid of chips, IC1 and IC3 can be combined into a dual unit sold as the 556.

Other serial printers can use this circuit. The ASR-33 and similar machines are set for one start pulse, two stop pulses, no parity, and eight data bits. If you have a machine that requires some other combination, pins 35 through 39 of the UART allow alternatives. Pin 34, the control strobe, is hard-wired to +5 to allow these selections.

Now my VIC provides hard copy. In addition to ham QSOs, I can tune in AP from London or the XINHUA news agency from Beijing, China, and read the printed copy. You know, it just dawned on me that I can get the same thing for 25¢. It's called a newspaper. And it has comics, too. Hmmm, does anyone have information on commercial FAX converters? ■

Si Dunn K5JRN
928 W. University, Suite 610
Denton TX 76201

KOKO—The Kids' Own Kode Oscillator

Watch those little eyes light up when your children "play ham radio!"

Number 8 on your Feedback card

One night recently, as I concluded a short contact on CW, I felt tuggings at the sleeve of my keying arm. At my side stood a delegation of two: Sammy, age 8, and Shelly, age 9.

"Daddy," they announced in ragged unison, "we want to learn Morse code."

Pleased, I sat them right down and taught them the letters "E," "T," "I," and "M"—in minutes, they could copy the word "time." Young minds do learn quickly.

But the sidetone of a Kenwood TS-520S is an expensive code practice oscillator. And the kids certainly could not (and better not!) lug my transceiver off to their rooms to practice. They needed their own code oscillator. So KOKO (the Kids' Own Kode Oscillator) was born.

This circuit was designed, built, and tested in less than two hours. At times, the kids watched the wiring, and I tried to explain what some of the parts do. But mostly, they just coughed dramatically, pinched their little noses, waved their hands, and complained: "Daddy, solder stinks!"

They'll learn. They'll learn.

A Simple Circuit

The Kids' Own Kode Oscillator is a very simple circuit. You can tailor it to fit the parts you have on hand. You also can use it with a small speaker instead of earphones.

If you enjoy being fancy, you can drill and etch a printed circuit board. Or you can use a piece of perfboard and point-to-point wiring. Mr. (Lazy) Wizard here chose one of Radio Shack's pre-etched and pre-drilled single IC boards (part number 276-024). KOKO's parts take up only a third of the available space on that board, so plenty of room is left over for refinements or outsized components from the junk box.

The 555 timer and eight-pin socket are mounted on the un-coppered side of the board. The rest of the circuit's components are soldered to the copper pads. The board and 9-volt transistor radio battery all fit nicely inside a small minibox or plastic enclosure.

When keyed, the oscillator draws about 8 or 9 milliamperes from its 9-volt battery. With proper care, KOKO's battery will outlast the batteries in most motorized toys.

Setting the Tone

Potentiometer R3 varies the pitch of the audio-frequency oscillation. For greater economy, R3 can be replaced by a standard-value fixed resistor, such as 68k or 47k. The only disadvantage is that to change the pitch to a higher or lower frequency, you have to unsolder the resistor at R3 and replace it with another value.

If a standard-value resistor doesn't quite give you the desired audio frequency, you can wire one or more lower-value resistors in series with it or string several resistors together until you get the pitch you prefer.

Another way to change the frequency of the oscillator's tone is to use higher or lower values of capacitance at C3. Or try shunting

Parts List

Resistors	
R1	1k-Ohm, 1/4-Watt or 1/2-Watt (see text)
R2	2.7k-Ohm, 1/4-Watt or 1/2-Watt
R3	100k-Ohm potentiometer (see text)
Capacitors	
C1	.1-uF disc ceramic or similar
C2	10-uF, 25-WV electrolytic
C3	.01-uF disc ceramic or similar (see text)
Miscellaneous	
U1	555 timer (Radio Shack 276-1723)
J1, J2	Two-conductor phone jacks
S1	Single-pole, single-throw switch (slide or toggle)
	Telegraph key
	Low-impedance (8- or 16-Ohm) earphones or speaker
	Phone plugs to match J1 and J2
	9-volt transistor radio battery
	Battery connector
	Metal or plastic enclosure
	Printed circuit board (Radio Shack 276-024) or small piece of perfboard
	8-pin IC socket (optional)

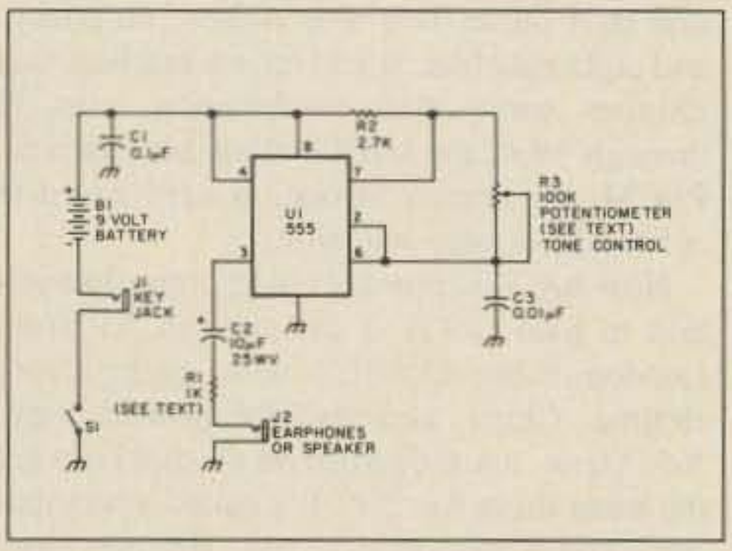

Fig. 1. You can show your kids KOKO's parts and how they're drawn on the schematic.

various disc-ceramic capacitors across the capacitor at C3 until you like what you hear.

Volume Control

Resistor R1 sets the volume in the earphones or speaker. A value of 1k gives a comfortable listening level in a cheap pair of 8-Ohm earphones or one of those tiny monophonic earpieces.

For room-level volume—to teach the code at a radio club meeting, for instance—change R1 to a much lower value, such as 100 Ohms or 22 Ohms and use a small 8-Ohm or 16-Ohm speaker in place of the earphones. But keep a spare battery handy; the 555 timer draws nearly 50 milliamperes in this configuration.

To Switch or Not to Switch

Switch S1 definitely is a frill that can be eliminated from KOKO. However, I added a single-pole, single-throw slide switch and attached labels that say ON and OFF because I wanted the junior operators to learn proper respect for power switches.

Now, when I'm working DX, and I feel a tug at my sleeve, it's usually a happy kid announcing, "Daddy, I just sent 'CQ Cabbage Patch Kids'!" or "Daddy, I just worked Mister T on six meters!"

If you're wondering where all the new hams are going to come from, look around your house or neighborhood. Would a youngster you know (or a stodgy adult) enjoy having his or her own code-practice oscillator? ■

I. M. Gottlieb W6HDM
931 Olive Street
Menlo Park CA 94025

Cosmic QRN

Are there messages in the noise?

In the event that neither ancient sage nor modern guru has enlightened us that one thing leads to another, let such words of wisdom hereby come into being.

The "one thing" commenced one evening while I was relentlessly rocking the channel-selector knob on my TV set. I was, of course, conducting the ever-going search for program material not too insulting to my intellect nor too shocking to my emotions. After having scanned the usual collection of pantyhose ads, get-rich-quick schemes, maximized discord known as rock "music," and scenarios of violence untempered by man's experiments with civilization, I finally wound up on a UHF-channel midway between two rather anemic stations.

There I sat, utterly transfixed with the dancing specks of snow on the TV screen. How long I endured in this posture I do not know. I must confess, however, that the ever-changing, yet ever-the-same display proved of greater interest than any of the program material I had briefly appraised. Indeed, while I cannot prove that I had fallen into a hypnotic stupor, I recall only that the experience was pleasant, serene, and downright compelling.

Upon slowly recovering from this daze, I found myself aware of some rather strange aspects of the flurry of particles gyrating before my eyes. Superimposed on the random display, I thought I observed symmetrical patterns and geometric shapes—some were formed of straight lines, but others resembled the curved outlines of flowers. And, intermixed with the black and white specs were transient flashes of red, blue, and green.

Now, maybe this wouldn't have astounded you, OM, but seeing such colored snow on a vintage vacuum-tube black-and-white TV set abruptly alerted my drowsy brain and started me on a wild thinking spree. My initial deduction was that it must be possible to receive color programs on an ordinary black-and-white set. All I would have to do is identify the mechanism responsible for the "leak-through" of color modulation and then optimize its effect.

Alas, as you may have deduced, it was not to be! But even if I did not emerge as a newly made millionaire from a great technological breakthrough, all was not lost; the experience engendered other interesting ideas, which I would like to share with you.

Noise = Nuisance? No

Noise may be a nuisance, but it stimulates conjecture.

I am by no means the first alleging to have seen something other than pure randomness in the noise coming out of the video channel. The eye is notorious for its ability to generate illusions. Phosgenes—the stars and other geometrics you "see" as the result of mechanical pressure on the eyelid—can be stimulated in various ways. And, when the brain gets into the act, you can all too easily perceive depth, movement, color, or objects that do not exist.

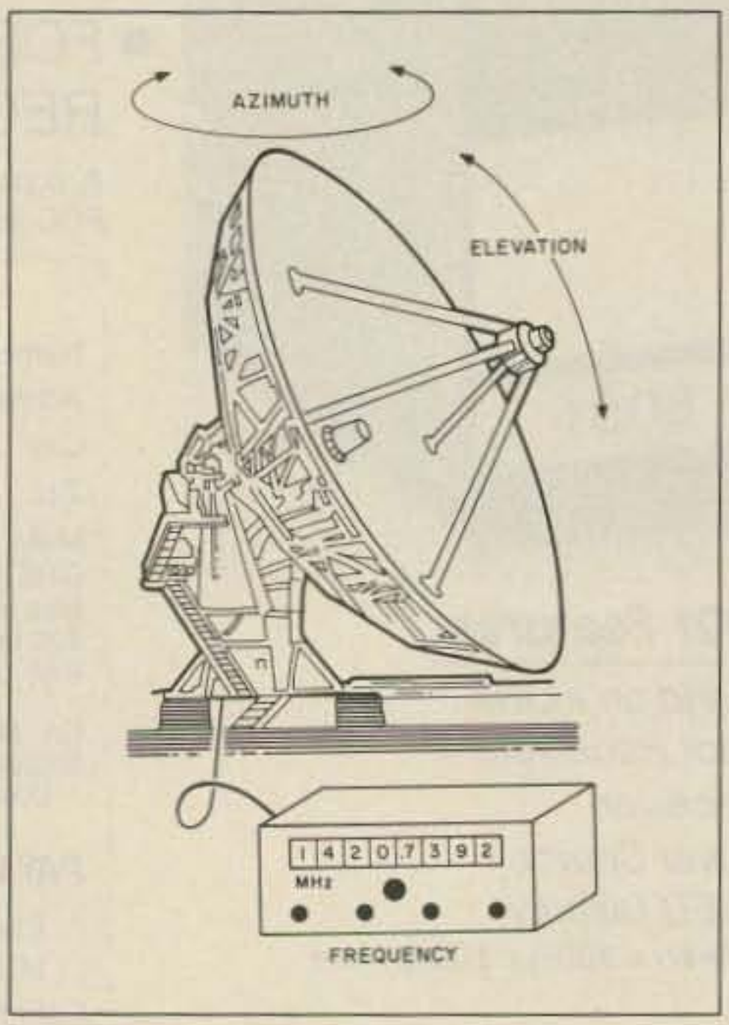

Fig. 1. Seeking the needle in the haystack. Pointing at the right place in the sky and tuning to the right frequency pose a horrendous burden on the probability of detecting an extraterrestrial.

Notwithstanding all this, it is both intriguing and interesting to speculate on the possibility of intelligence or information being *contained* in a noise spectrum. If one didn't know otherwise, the rat's nest of wavy lines that comprise the oscilloscopic display of TV video modulation could be interpreted as electrical noise from a worn motor brush or from a defective fluorescent lamp. Hams have long been familiar with techniques for extracting weak signals from a background of noise, QRN, and interference. And we know that these techniques have been carried to sophisticated levels in radar, in sonar, in the reception of data from space vehicles, and in radio astronomy.

During recent years, a whole new communications technology has evolved around a more elegant concept than the mere extraction of signals from noisy backgrounds. Known as spread-spectrum modulation, the new technique comes quite close to using noise itself as the carrier of information. We find ourselves reminded of the adage, "If life gives you lemons, make lemonade." In a somewhat analogous manner, this discussion will speculate that nature (and maybe extraterrestrial intelligence) has *already* put noise spectra to good use!

Noise = Nuisance? Yes

Noise was put here to degrade communications—or so it seems.

Some illumination can be cast on our speculation that intelligence may reside in noise by considering briefly the close link between noise and entropy (which tells us that ultimately all matter in the universe will attain the same average temperature). Both signify vanishing coherence and engulfing randomness. Under such an eventuality, there will no

longer be any evidence of logical arrangement, ordered sequence, or privileged position. Here, it is interesting to contemplate that the speed of light in empty space is forbidden to matter and limits both energy *and* communications.

Electrical noise in its idealized form is known as "white noise" and is composed of a purely random selection and sequence of frequencies and amplitudes. Although the rigorous definition of white noise requires an infinite bandwidth, practical white noise is said to exist when a finite spectrum of the disturbance exhibits equal energy per unit bandwidth. Thus, in an audio system, equal loudness would be perceived for, say, any 100-Hz band; such bands could be from 100 Hz to 200 Hz, 600 Hz to 700 Hz, or 2,300 Hz to 2,400 Hz, etc. On the other hand, so-called "pink noise" is characterized by equal energy per octave. This means that the same energy would be contained in the 100–200-Hz band as, say, in the 500–1,000-Hz band.

There are many other types of noise spectra, but in communications work they all tend to have similar effects with regard to the transmission of intelligence. That is, they all *sound* like noise and are known for their abilities to drown out or otherwise degrade or destroy intelligibility. As far as our ears or eyes are concerned, noise replaces coherence and logical sequence with randomness.

Considering the prevalence of noise sources—terrestrial (man-made), galactic, thermal, and interfering stations—it almost seems that nature is against us in our pitiful efforts to squeeze narrowband modulation formats through a vast sea of noise energy. Inasmuch as noise will not go away, could we possibly find another way of dealing with the problem?

Yes and No Noises

There are noises and then there are noises.

Some of the noise in nature may one day be found to be something more than stray energy in quest of the most random format of distribution it can find. Physicists with the boldness and imagination needed to deviate from the views of establishment science have suggested that there may be a counterforce in nature in which systems tend to evolve *from* randomness *to* patterns of more logical distribution, and from simplicity to complexity. Note that this goes contrary to entropy in which complexities break down and coherence degrades into a homogenized crazy quilt.

Interestingly, in the domain of organic evolution, we apparently do see evidence of "reversed entropy." Are we not told that complex life forms descended from simpler forms? And surely there is greater logic in the brains and nervous systems of higher animals than of lower ones. Thus, in the countless billions of trials, experiments, extinctions, and mutations conducted by nature over billions of years, there has been some kind of reasoned goal—a thread of coherence within an apparently blind randomness of purpose. In communication terms, we could say that there has been a signal buried in the noise!

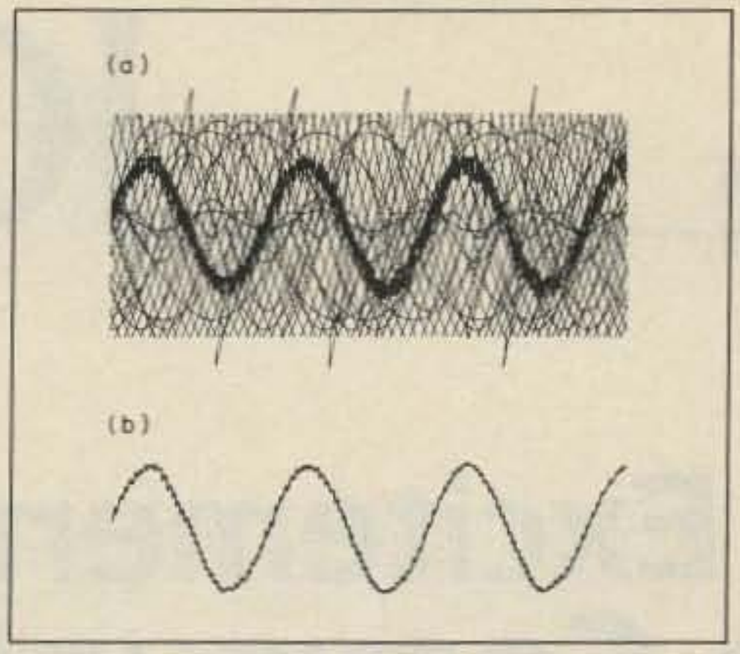

Fig. 2. Recovery of a signal from a background of noise. (a) The commonly encountered signal-plus-noise format. (b) The extracted signal after processing by filtering, integration, or correlation techniques.

The universe is alive with radiant energy involving frequencies in the radio, microwave, optical, X-ray, and gamma-ray spectral regions. All told, these radiations assume the characteristics of a lot of meaningless wideband noise. Upon closer scrutiny, it has been discovered that "every little photon has a meaning of its own"; more has been learned from spectroscopic interpretation of such radiation than was ever even suspected previously.

Not only can we infer the composition, temperature, dynamics, and history of distant worlds, but various hypotheses (even those bordering on fantasy) can be propounded that otherwise would be totally lacking in support. But let us not forget that much of yesterday's science fiction is today's technological hardware.

If you keep up with the literature on the subject, it certainly must appear that we are closer than ever before in our quest for the reception of radio signals from other worlds. Receivers are more sensitive than before and they generate much less noise. Antennas are larger, producing more gain, and they discriminate better against noise from terrestrial sources. And front-end selectivity has been enhanced to the extent that minimal galactic noise is admitted.

The greatest advance has been in the strategy of the search program itself. Previously, a tiny sector of the sky was scanned in frequency, and then the process was repeated for other small patches of the celestial sphere. This was, of course, both laborious and inefficient considering the size of the universe together with the extensive frequency range that could conceivably bear meaningful modulation.

Sometimes simplifications were made in attempts both to decrease the searching task and to enhance the probability of success. One such technique involved the notion that extraterrestrials would be smart enough to transmit in the band bounded by the natural radiation of hydrogen (1420 MHz) and the hydroxyl ion, OH (1662 MHz). We suspect the predominent element in such searches was none other than the fickle nature of lady luck. She has yet to smile on our endeavors!

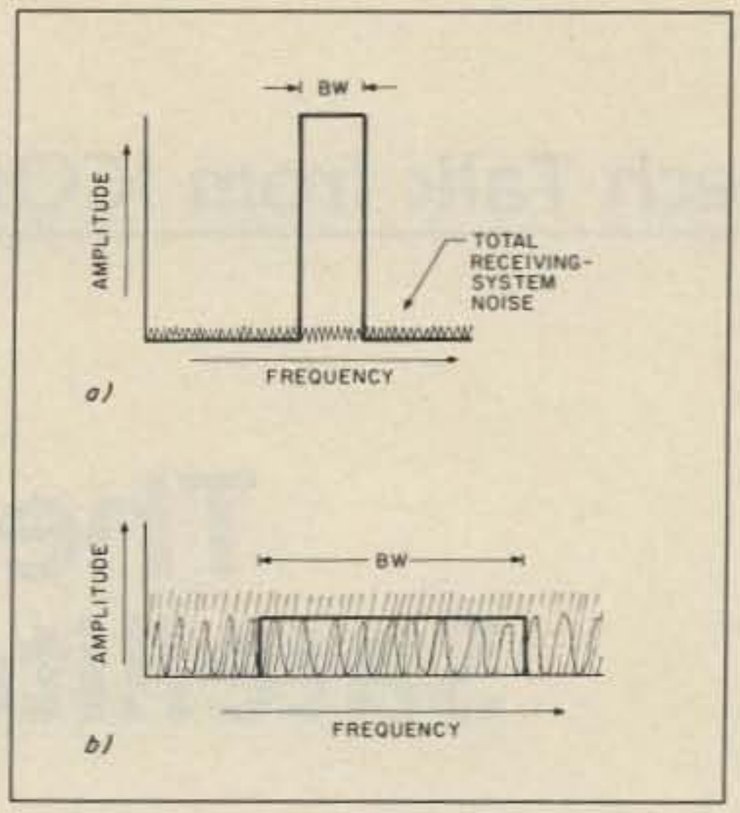

Fig. 3. Comparison between conventional and spread-spectrum signals. The power density of the spread-spectrum signal is very small compared to conventional modulation formats; indeed, the spread-spectrum signal may even be below the noise floor of the receiving system. (a) An ordinary signal in the rf spectrum. Here, the bandwidth may be about 3 kHz. (b) A spread-spectrum signal. Bandwidth could be a hundred thousand times wider than the bandwidth of the ordinary signal.

Sophisticated computer programming can now automate the process. The computer can evaluate a signal that is peculiar by virtue of its coherent, logical, or non-random format. Of course, the hoped-for signal will have originated from a civilization not too many light-years distant so that an eventual two-way QSO will not entail much more than a human generation.

But, tuning in a narrowband signal and excluding noise may have some holes in it. Inasmuch as noise is so much a part of the universe, why not suppose that those brainy extraterrestrials have devised methods of harmonizing with this fact of nature rather than fighting it?

Broaden the Noise?

Spread-spectrum modulation—putting "broadband splatter" to work.

By hint and allusion, suggestions have been made that apparently random broadband noise can contain coherent information. Nowhere is this better demonstrated than in the now evolving technique of spread-spectrum communications.

Spread spectrum, as the term implies, is a broadbanded modulation format. However, it must not be thought of as merely involving a wider frequency range than more conventional modulation spectra. If that were the case, all one would have to do would be to increase the deviation of an FM signal. But such a stratagem would fail to yield the unique features of the spread-spectrum technique.

Not only is a spread-spectrum signal *very* much broader than you could readily produce with a high-deviation FM signal, but the frequencies in spread-spectrum transmission are

Tech Talk from ICOM

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An ever increasing number of radio amateurs are joining the excitement of Phase III-type satellite communications, and there are some good reasons. This new medium combines the communications range of the 20 and 80 meter bands with the line of sight reliability of 2 meters in a completely perfected manner. It's equivalent to a totally new band, it's unaffected by sunspot variations, and a vast technical background isn't necessary for enjoying the action.

ICOM America stands ready to help you enjoy the fascinating new capabilities of OSCAR 10 and future amateur satellites, and it has a full line of equipment to back that statement. Its all mode 2 meter and 70 cm base transceivers bring the operating conveniences of low band units to the VHF and UHF amateur bands. They can be used for local FM operations via repeaters or for SSB/CW communications via any Phase III OSCAR satellite. The new IC-1271 all mode 23 cm transceiver is in a class of its own, providing mode L satellite uplink capability (mode L is 23 cm uplink, 70 cm downlink) and optional fast scan amateur TV operations using home video equipment.

The overwhelming preference of mode B equipment (435MHz band transmit, 145MHz band receive), among OSCAR groups and users, is ICOM's IC-271H and IC-471H transceivers. Why? Satellite relayed signals are somewhat weak in nature, and the IC-271H's low noise/high sensitivity receiver gives the highest possible performance for hearing everyone regardless of their uplink performance. The IC-271H's noise blanker also prevents pulse-type electrical interference from masking some highly desired DX signals, and its selectable AGC can follow fast fades associated with spin modulation. There are also 32 all mode memories which can be used for intermixed FM repeater and SSB/CW operations. When the IC-271H is equipped with the optional mast-mounted AG-25 GaAsFET preamp, it becomes a satellite operator's dream come true.

ICOM's IC-471A (25 watts output) or IC-471H (75 watt output) 70 cm transceivers boast an output signal that's recognized on the satellite by its crystal clear audio. Power output of either unit IC-471A/IC-471H is continuously front panel adjustable to adjust to daily signal variations. This sidesteps the taboo practice of overloading a satellite's on-board receiver. The IC-471A/IC-471H also includes 32 all-mode memories for the ultimate in operating flexibility.

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Operating OSCAR 10's popular mode B is almost as easy as operating an HF band. The satellite's band centers are 435.100MHz uplink (receive from ground operators) and 145.900MHz downlink (transmit back to ground operators), with its band edges roughly 50KHz above and below those frequencies. Assuming both transceivers are tuned to band centers, ones own satellite-relayed signals can be received while transmitting and used for "tweaking" antenna positions and offset-tuning doppler shift. OSCAR 10's inverting passband is then tracked as follows: for each KHz the IC-271H's receiver is tuned above 145.900MHz, the IC-471A/471H's transmitter should be tuned an equal number of KHz below 435.100MHz to "zero beat" others. The accurate readout of ICOM's digital displays even eliminate the need to "talk one-self onto frequency."

If you're interested in joining today's most exciting era of amateur communications, OSCAR 10 and future Phase III satellites are the medium to use. If you appreciate top performance equipment for those activities, ICOM is the logical choice. It's simply the best, and it's backed by an uncompromised policy of top service. Isn't it time you enjoyed these exciting pleasures?

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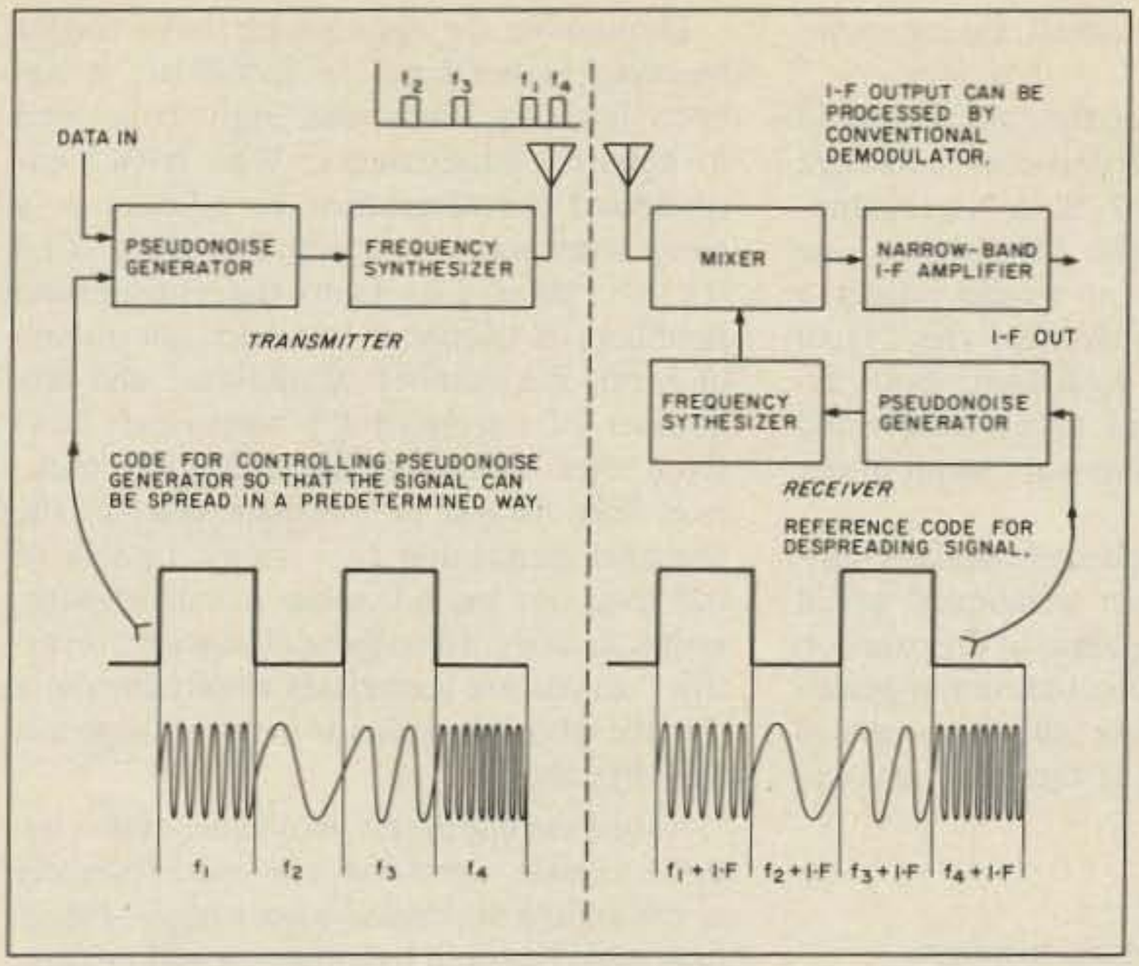

Fig. 4. Simplified block diagram of the spread-spectrum communications link. This "frequency-hopping" system transmits and receives over a bandwidth that is many times that of the data. The actual spectral distribution of the signal is controlled by a predetermined code that must be the same for both transmitter and receiver.

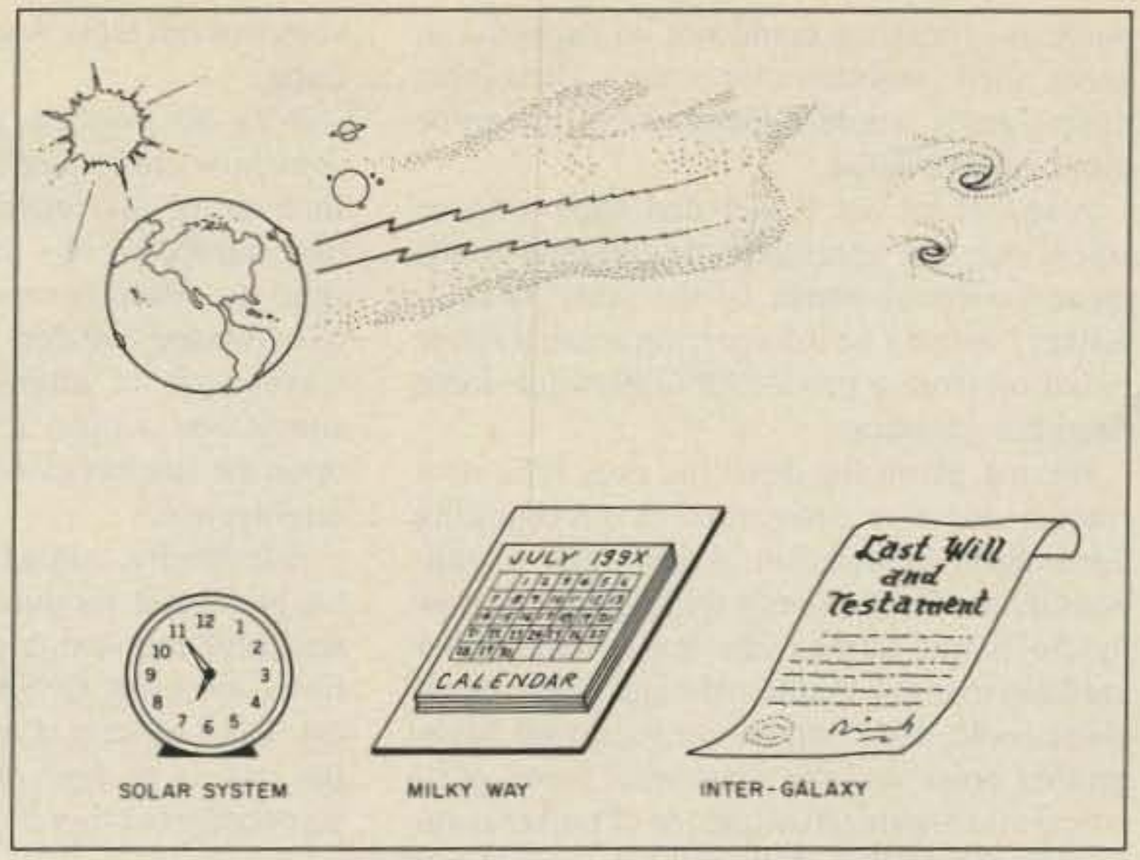

Fig. 5. Propagation time is presently an insurmountable problem. Ranging from minutes, hours, and days to years, generations, and millenia, the solution to this problem would require a true scientific breakthrough.

unrelated to the modulating information. Rather, the spread-spectrum frequencies are generated in near-random fashion throughout a wide, but prearranged frequency range. This is accomplished by the so-called pseudo-noise generator.

The pseudo-noise generator causes a time and frequency distribution of the rf in such a way that a conventional receiver would deliver a hissing sound, which could easily be interpreted as just some more noise background. Indeed, the hiss might even be *submerged* in the overall noise of the receiving system. This is because the power density of the spread-spectrum signal is extremely low, the total power being spread over such a wide band.

In actuality, the time and frequency distribution of the spread-spectrum signal is not a random occurrence. Rather, it represents a predetermined *code*. This requires that the receiver know this code in order for the inverse operation, de-spreading, to be performed. Once de-spread, the signal can be demodulated by conventional means so that the original information can be recovered.

It follows that not only must the receiver have the same code that produced the spread-spectrum format in the transmitter, but means must be provided so that the de-spreading operation in the receiver is *synchronized* to the spreading operation in the transmitter. Otherwise, there will be no response to the signal. A corollary of this is that this communications technique is inherently immune, or very nearly so, to interference from conventional signals, other spread-spectrum signals, intentional jamming, and other disturbances.

There is more than one way to produce spread-spectrum modulation. A straightforward approach is frequency hopping. As the term suggests, the frequency is hopped all over the spectrum. The hopping is done according to a code and must be de-hopped in the receiver by means of the same code. Although spread-spectrum modulation may appear to be fearsomely complex, the use of VHSIC dedicated modules, processors, charge-coupled devices, surface-wave acoustic devices, and other high-technology components renders this communications technique both practical and reliable.

Narrow the Noise?

Narrow band, high selectivity, and low-noise amplification, but no cosmic signals!

If an extraterrestrial were trying to alert or communicate with us, would a spread-spectrum signal of some kind make sense? A knee-jerk answer would be no, for the reason that we do not have the de-spreading code necessary for the recovery of modulation. However, this need not be construed as an insurmountable obstacle by the extraterrestrial. For one thing, if it were suspected or even hoped that we have technological moxie, it would not be unreasonable for him to endow us with the capability of empirically or logically deriving the needed code. On his part, the extraterrestrial would have used a relatively simple code, perhaps one linked to some mathematical progression or some universal constant that scientists worth their salt could be expected to know, their galactic homeland notwithstanding.

". . . our search for messages in the electromagnetic noise from the cosmos may not be so foolhardy after all."

Lest this speculation seem altogether farfetched, you can bet your boots that we and our terrestrial adversary have made a measure of progress in extracting data from each other's spread-spectrum communications. Also, consider the prospects of our present efforts in trying to detect a narrowband signal from an extraterrestrial. The probability of success may be quite close to zero because of rf pollution here on Earth. Also, we would *still* be faced with the problem of recognizing a modulated signal as such and then interpreting the logic contained in it.

The prospects of our finding a narrowband signal in the vast sea of QRM and QRN is not too rosy, and the extraterrestrial may well be aware of it. It is not at all unreasonable to suspect that the extraterrestrial might elect to conduct his probes with a spread-spectrum signal. For then, his QRZ or CQ might be fished right out of the prevailing noise level by us earthlings, who would be spared the Herculean task of shifting through millions of discrete frequencies.

Who knows? A broadband chunk of galactic noise may be coherent communications when properly processed. Most of us have been so thoroughly conditioned to the ongoing objective of *reducing* bandwidth that the concept of sending data by *simulating* the noise spectrum is, admittedly, a bit hard to swallow!

Kick the Noise Around

Manipulated noise from space—pro and con.

In the spirit of fairness and objectivity, I feel compelled to play devil's advocate and argue against the idea that signals from other worlds might use spread-spectrum modulation formats—or something akin to it. To my mind, the strongest argument against this hy-

pothesis is that we could not be expected to know their pseudo-noise code. Therefore, their signals would appear to be just some more galactic noise.

Also, let us not forget that such a space signal may not necessarily be targeted at this inconsequential planet of the solar system. Rather, we may be intercepting some leakage radiation from a private QSO between some neighbor galaxies.

Having given the devil his due, let's now reason out our prospects of recognizing meaningful modulation amidst a sea of random noise. Even though we might not know the full nature of the code, it is not altogether unlikely that our mathematicians and statisticians could differentiate between true background noise and the somewhat more periodical and organized sequence of pulses comprising the signal. Although we would not immediately know what was being said, there might be strong suggestive evidence that someone out there was, indeed, saying something.

Why not assume that the coding would somehow make use of universal constants such as pi and epsilon? Such an assumption surely is not unlike the present one that the extraterrestrial would select a narrowband carrier at or near the 21-cm wavelength of atomic hydrogen. Both assumptions would seem to be predicated upon the suspected evolutionary status of our intelligence.

Admittedly, spread-spectrum or similar ultra-wideband modulation techniques would *not* solve the vexing problem of propagation time—two-way QSOs don't seem too practical. But one step at a time; the first order of the day is to find out if there is (or was) somebody out there!

Noise by the Numbers

Seeking messages in noisy numbers.

Throughout the ages people have sought meaning in numbers. In particular, it has been felt that there was logic concealed in apparent randomness. Who hasn't encountered the entertainer or jokester at a party who purports to uncover some vital statistic about one from the appropriate jumbling of telephone numbers, the month of birth, the number of siblings, and any number of unrelated (?) numerical data? Even after unraveling the underlying trick, it is only natural to speculate whether the numbers pertaining to various aspects of our lives do, indeed, relate to our identity, status, and fate. Even those of us with "scientific" minds are sometimes uncertain where the line of demarcation is between hogwash and objectivity.

As an example of this, mathematicians continue to seek significance in the apparently never-ending decimal sequence of pi—the relationship between the diameter and circumference of a circle. Although the modern computer can spit out pi to a million decimal places, there remains no hint that this "exact" ratio will ever prove to be anything but an infinite series.

Yet, there appear to be clues that the pattern is something more than randomly occurring numbers. This is not, strictly speaking, mathematical. On the other hand, it is too fortuitous to be labeled coincidental. Nor is the "magical" allusion satisfying. It certainly seems that an apparent hodgepodge of digits is used by nature to harbor patterns, logic, and meaning. Assuming such to be the case, our search for messages in the electromagnetic noise from the cosmos may not be so foolhardy after all.

Concluding Thoughts

The basic theme of this exercise of the imagination is that there may be logic and intelligence in what we blandly describe as noise, as randomness in the electromagnetic spectrum. Just as some scientists now think that energy may reside even in a "pure" vacuum, messages in the form of communications and/or guidance could conceivably be contained in the cosmic radiation that permeates the universe.

Such speculation relevantly relates to the whole gamut of mankind's intellectual probings, including cosmology, theology, biology, chemistry, evolution, and communications. It also whets the thinking of those dealing with science fiction, science fantasy, and future trends of technology.

Admittedly, the transition from extrapolation to fantasy may have been crossed in some instances, but innovation, creativity, and discovery stem as much from wild as from disciplined thought processes. Indeed, the difference between the acceptable and the unbelievable is often fuzzy and unclear. Even though we continue ruthlessly to root it out of our communications systems, it is hoped that noise spectra will merit a bit more respect and dignity than it has hitherto been accorded. ■

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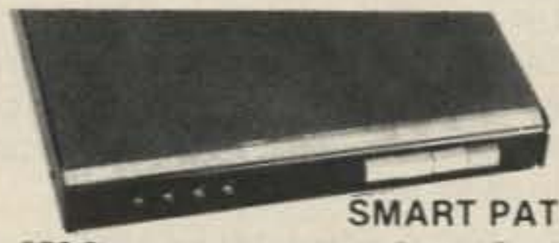

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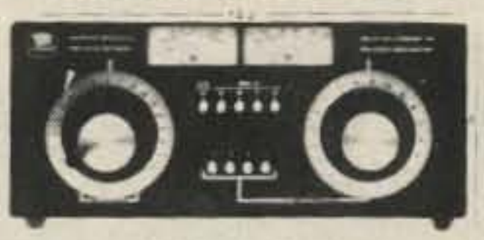

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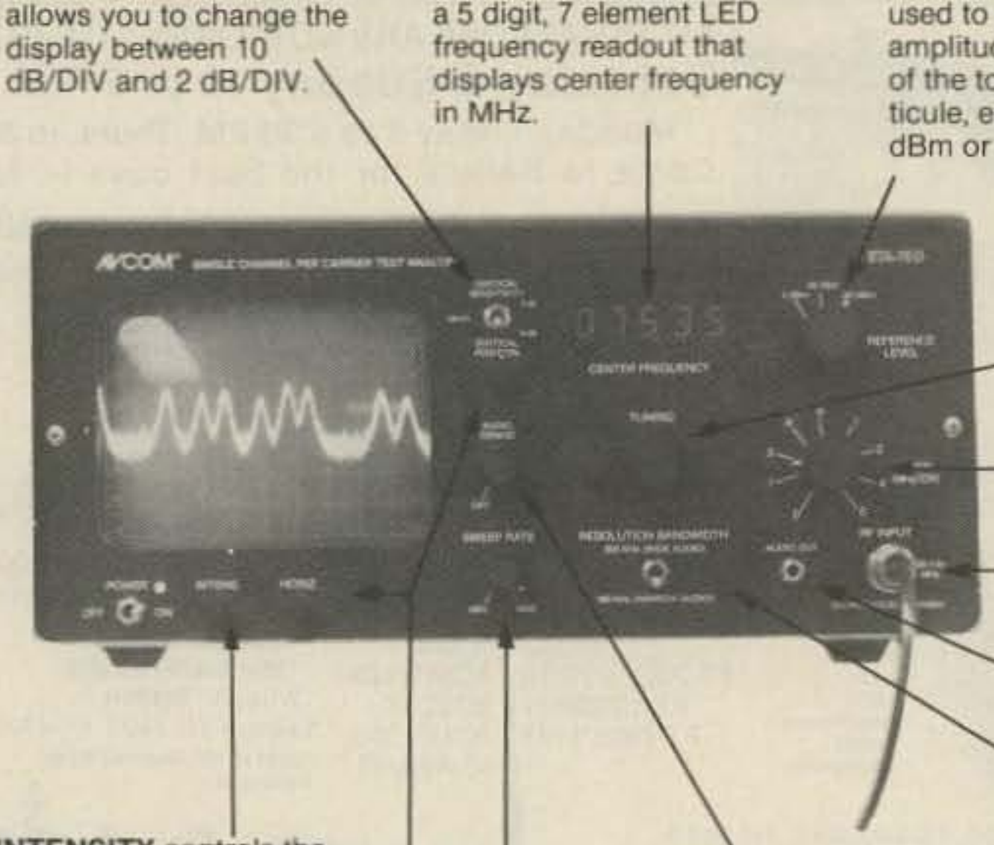

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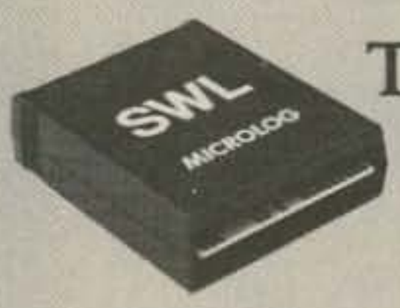

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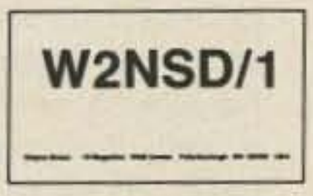
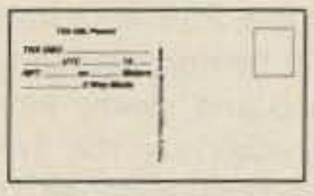




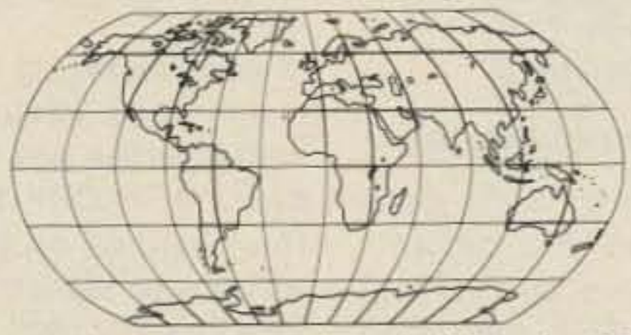
Reverse

QSLs

Now you can get the highest quality QSL cards without spending a fortune! We put these cards on our press as filler between jobs; it gives the pressmen something to do and lets us print QSLs for you at an absurdly low price.

Not that we skimp: All three styles are produced on heavy, glossy stock, in two colors (blue globe or satellite with black type). At these prices, you can start the new year out right by QSLing all those disappointed hams who've been waiting for your card. Tell 'em the card was printed by Wayne!

The World Is Your's For Only $5.00



Yes, places you've never even heard of! Nearly 400 DX countries gleaned from the Awards Lists of dozens of IARU members—more countries than any other map available anywhere! ARRL's DXCC map doesn't even come close!

73 Magazine offers readers our DX Map of the World for the absurdly low price of only $5.00, shipping and handling included.

Your ham shack will be incomplete without this giant, 950-square-inch, up-to-date map. It's printed in classic black and white, permitting you to color the countries in after you've QSL'd them. (Apartment-sized map available at no extra cost.)

Save yourself the humiliation of never having heard of McDonald Island (what's the prefix?), Jan Mayen (prefix?) or Kure Island (prefix?).

Order now....

Code Tapes

We've had so many phone calls from people wanting our famous 73 code tapes that we've decided to bring them back!

"Genesis"

5 wpm–This is the beginning tape, taking you through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way. The ease of learning gives confidence even to the faint of heart.

"The Stickler"

6+ wpm-This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm. Code groups are entirely random characters sent in groups of five—definitely not memorizable!

"Back Breaker"

13+ wpm-Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language at only 13 per. You'll need this extra margin to overcome the sheer panic universal in most test situations. You've come this far, so don't get code shy now!

"Courageous"

20+ wpm-Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the Extra class license. We send the code faster than 20 per. It's like wearing lead weights on your feet when you run; you'll wonder why the examiner is sending so slowly!

Classics From 73's Library

•***The Magic of Ham Radio***, by Jerold Swank W8HXR, begins with a brief history of amateur radio and Jerry's involvement in it. Part 2 details many of ham radio's heroic moments. Hamdon's close ties with the continent of Antarctica are the subject of Part 3. In Part 4 the strange and humorous sides of ham life get their due. And what of the future? Part 5 peers into the crystal ball. Only $4.95.

•***The Contest Cookbook***, by Bill Zachary N6OP. One of ham radio's winningest contesters lets you in on the tips and techniques of the Big Guns. You'll learn which duping method to use, find out what equipment you'll need, and discover the secret of building a pileup. Includes separate chapters on DX and domestic contests. $5.95 while they last!

QSL Cards Style: ☐ W ☐ X ☐ Y

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Code Tapes

Genesis	$6.95	_____
The Stickler	$6.95	_____
Back Breaker	$6.95	_____
Courageous	$6.95	_____
Postage and Handling		$1.00

Giant DX Map of the World $5.00 _____

Total Enclosed _____

Please print!

Name _____ **Call** _____

Address _____

City _____ **State** _____ **Zip** _____

☐ AE ☐ MC ☐ VISA ☐ Check/MO

Card # _____ **Exp. Date** _____

ORDER FORM

Mail your order to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Uncle Wayne.

QRP

Number 24 on your Feedback card

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

OPERATING TECHNIQUES

I will try to tie up some loose ends this month. But before I get started, let me take time to discuss some QRP operating techniques.

For some strange reason, I decided to work the 1986 *CQ* WW DX contest. For a real challenge, I jumped in with both feet running SSB. So there I sat, running 2 Watts PEP output into a tri-band beam up about 40 feet. Not exactly a rock-crushing station. I figured I could work a few new ones, and a new one to me is Delaware! So for what it is worth, here are some good QRP operating tips you can put to use. Even if you're not running low power, these tips may help your overall operating.

So let's start. The old statement "You can't work 'em if you can't hear 'em" still holds true. However, running low power requires far better listening and more of it. Before you even think about pushing the microphone button, listen to the stations that are being worked. Are they on EXACTLY the same frequency as the DX station, or are they over to one side of zero beat? While this may sound unimportant, it may make the difference between a contact and an empty log book.

If the DX station constantly answers stations to one side of his frequency, you'd better get on that side before you call. Just as important, does the DX station answer the first call in the pileup or the stations that are calling last? If he is waiting for the tail enders, pause a second, then give your call.

Here is a second good operating tip. How is the operator on the DX side handling the pileup? Does he have the pileup under control, or is it a total mess? While I'm not much of a DX chaser myself, I can very easily tell the good operators from the bad. I like to hunt and peck when I chase DX in a contest. If I come up to a pileup in which the operator has control, I have a very good chance of getting heard with my 2 Watts. If the operator is not in control, with total mayhem on his frequency, I'll never be heard. I then just move on.

While tuning up and down the dial, I don't waste time on the stations that are running sections. With QRP power levels, the chances of getting heard within your section are slim. You then have to wait till your section comes around once again. The QRP operator has a better chance calling with everyone else.

During the contest, I was tuning around on ten meters when I came upon 3G3DX. Here was this station running herd on the W/K stations. I tried several times and could not seem to break the pileup. All of a sudden, 3G3DX stopped and asked that only QRP stations come back. Well, I'm impressed! My hat goes off to him. No, he did not hear me, but I did get a good break. I must not forget all the other higher-powered stations that did wait till he worked some of my QRP brethren. As for the few who took advantage of the QRP standbys, beware!

Listen and follow the instructions the DX station operator may be giving out. If he asks that only the last two letters of your call be given, then that's what you do.

Keep an eye and ear on how the bands are running. If the DX station is only S3, and assuming propagation is equal in both directions, your QRP signal will be almost unreadable. Remember, you will be about 3–4 S-units lower than a 100-Watt station. Call only the louder stations first, then try your hand at some of the weaker ones.

Try sending your call out only half a dozen times to one station. If you can be heard at all, that many times should do. After six tries, move around and try a second station. If you have no success, go back to the first station and start the tactic all over.

When you use SSB, your transceiver should be adjusted so the audio is crisp and clean. When signing your call, use the International Telecommunication Union Phonetics. Speak your call in a normal tone and speed. You're not out to break any speed contests. Don't waste your time adding QRP to the end of your call. It takes too long and more than likely will go unnoticed. Since I have a two-by-three call, I use only the last three letters, with special articulation on the last letter, "echo." Using this method, that "echo" has allowed me to work a few new DX countries.

By using these operating tips, I was able to work 68 countries in about eight hours of contesting. Yes, there were some stations that I thought I should have been able to work and didn't. There were also some stations that I worked on the second call, using my 2 Watts of power. Just remember, all these tips are just that, tips. Feel free to change them to suit your needs. Running QRP DX is truly "wits in place of Watts."

LOOSE ENDS

Now for those loose ends. Digging into the mail bag brings a letter from D. Paul Ridley KB5DQ, asking for help in modifications for the Ten-Tech Argonaut 505. I remember sometime back in *73* Magazine an article on doing just that, but for the life of me I can't seem to find the issue. Perhaps someone may recall what issue it was in and let KB5DQ and me know. I purchased one of those critters at the Dayton Hamvention for $20. The guy who sold it to me said, "I'll send you the manual." I'm still waiting.

Mr. Ridley would also like to know if anyone still has copies of the old *Milliwatt* newsletters. I'd like to see some of those myself. If anyone does, I'll be happy to make copies of them and send them out to interested readers.

Bob Krieger KA0QHV writes to add a few more companies to the mail-order shopping guide. They are Digi-Key Corporation, PO Box 677, Thief River Falls MN 56701, and Dick Smith Electronics, PO Box 2249, Redwood CA 94064. Bob reports that both have fast service and low minimum orders. On the other hand, Bob tells me that he has had problems with Lolir Electronics and with Knappco Electronics of Florida. Just as I stated before in my Rules of Ten, these are only opinions. Make what you will out of the information.

There is quite a bit of interest in my WHD-40 transceiver plans. While I did send out what information I could, the cost of postage will drive me to the poor house. If I could only talk KW1O into a separate construction article for the project (hint, hint).

Speaking of postage, does anyone QSL anymore? I like to get cards from the different stations that I work, but the cost of mailing those cards, ouch! Some time ago, the USQS handled stateside and VE cards, but they went under. I would imagine from lack of support from the people using the QSL service. Not to see a good idea die, W. C. Wellborn K4CLA will offer the same incoming QSL service. The new service will be called KIQS (pronounced KICKS), which stands for K4CLA Incoming QSL Service. While I don't have the space here to print all the operating rules, here's the gist of things:

1) DX stations may send QSLs to U.S. homes via KIQS.

2) U.S. stations may send QSLs to other U.S. hams via KIQS.

3) Pre-sort QSLs numerically, then alphabetically by suffix.

4) One dollar is exchanged for four stamped envelopes of appropriate size, each bearing one ounce of postage.

Net	QRG	NCS	Day	Time (UTC)
TCN*	14.060	W5LXS	Sun	2300
SEN**	7.030	K3TKS	Wed†	0001
GSN	3.560		Thur†	0200
GLN	3.560	W3TS	Thur†	0200
WSN	3.558	NM7M W6RCP	Sat†	0200
NEN	7.040	W1FMR	Sat	1200
WSN	7.040	NM7M W6RCP	Sat	1600

*On weekends of major contests, net will meet one hour later.
**If conditions on 7.030 MHz are poor, QSY to 3.535 MHz at 0031 UTC.
†Evening of day before of W/VE.

Table 1. QRP net schedule.

5) If you have a card waiting and no envelopes, then notices will be sent as routine traffic via ham radio.

6) Do NOT send SASEs. They will not be accepted.

All this sounds like a good idea to me. For correspondence, QSLs, comments, and criticism, drop a letter off to KIQS-K4CLA, 562 Oak Drive, Lexington SC 29072. As QRP operators, let's get behind this project and give it support. I will.

A lot of the letters that I have received ask for information about awards for the QRP operator. Sometime in the future I'll do a column on the QRP ARCI. For now, for more information about the awards the club does offer, write to Awards Manager, Fred Turpin K6MDJ, PO Box 145, Cedarpines Park CA 92322. I'm sure that Fred will be able to fill you in as to the most recent awards the club is giving out.

The weather gets rather cold here in Ohio this time of the year. So what better time to try checking into the many QRP nets. They include the Transcontinental Net (TCN), the Southeast Net (SEN), the Great Lakes Net (GLN), the Gulf States Net (GSN), the Northeast Net (NEN), and the Western States Net (WSN). Nets are listed by day and hour (UTC) in Table 1. Make some friends and drop by to say "hello."

If checking into nets is not your thing, and the soldering iron is still hot, how about doing some modifications to the ol' Heath HW-8? Yes, you say, great idea. Where do I start? Well, first things first. Order a copy of the *Hot Water Handbook* from me. They go for $5 postpaid first-class mail in the U.S. and for $7 for DX airmail. The book contains more than 30 pages of modifications for the HW-7, HW-8, and HW-9.

I enjoy all the kind words that you have been sending me. Remember, it's your column; you supply the feedback that I need. Thanks also for the schematics, photographs, and information on the different circuits. I'll try to get some of them printed here in the QRP column.

That's about all I have space for this month. Next month, I'll scoop everyone with a lineup of QRP activity at the Dayton Hamvention.■

ABOVE AND BEYOND

Number 13 on your Feedback card

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

Last month I discussed important parameters to consider when selecting a preamplifier for VHF and UHF applications, specifically MDS (minimum discernible signal), IMD (intermodulation distortion), gain, and 1-dB compression point. All are interrelated, especially the latter three. Excessive gain can result in poor IMD performance and a low 1-dB compression figure. Conversely, a well-designed preamplifier may not have a very high gain figure, but will excel in the IMD and 1-dB COMP tests.

Note that we also have to take noise figure into consideration, especially at frequencies above 220 MHz. Below this frequency, the limiting factor is the ambient noise level on the band in question. To have a 144-MHz GaAsFET preamplifier with a noise figure under .5 dB is great, except that the atmospheric noise present on two meters might be 2 dB, so you haven't gained much of anything there.

At 432 MHz, device noise can be substantially higher than ambient band noise. Here is where noise figure really becomes important, for if a given preamplifier has a 2+ dB noise figure—not uncommon for a microwave bipolar transistor—it might not help you copy that really weak signal just above the ambient band noise level. It goes without saying that low noise figure is paramount at 902, 1296, and 2304 MHz; otherwise, communications could be impossible.

Noise figure measurements require special equipment, typically a noise figure meter such as that made by Hewlett-Packard. Such instruments can establish a noise baseline for a given frequency and measure any additional noise generated by a preamplifier at that specific frequency. MDS measurements are also very difficult to make unless you have access to an accurate spectrum analyzer covering the desired frequency range and a calibrated signal generator.

On the other hand, it isn't all that hard to make gain and compression measurements, and test equipment can be had cheaply to do the job. I've long relied on the standard Boonton Electronics model 92 rf millivoltmeter for precision measurements of low signal levels. Its displayed range is from −60 dBm to +23 dBm using eight switch-selected sensitivity settings. The standard rf detector is good to 600 MHz and, best of all, these units can be found at flea markets and surplus auctions for a few hundred dollars.

You'll also need a signal generator, and these are in abundance at auctions and surplus test equipment dealers. I recently purchased a Hewlett-Packard model 608F rf signal generator from Brian Kent of Kentronix (PO Box 2444, Allaire Airport, Farmingdale NJ 07727) in very good condition for about $300. This generator was long a mainstay in many service shops for both commercial and military work. It features a pencil triode oscillator, which is quite stable, and covers 10–450 MHz in six ranges. The output is variable from .1 uV up to 500 mV with a precision piston-type attenuator, and is easily calibrated with the built-in level tracking feature. (This latter option keeps the output constant as you move across a given frequency range.) Provision has also been made for connection to an external precision frequency reference—just like a vco (voltage-controlled oscillator) in a PLL (phase-locked-loop) circuit.

With such a generator, you can measure receiver sensitivity, preamplifier gain, selectivity, squelch law, and quieting levels (FM receivers only), i-f and filter bandwidths, and many other things. A signal generator might be one of the most useful items you can keep around the shack! So I decided to take the plunge and carted home the 608F (in a rack-mounted version, I might add). The manual was included in the price and is quite helpful, so try to locate one if you purchase such a unit.

Now, on to the actual measurement procedure. I selected four representative preamplifiers to demonstrate this process: (1) Janel Laboratories 50 PB 50-MHz MOSFET preamp; (2) Microwave Modules MMG144 144-MHz GaAsFET preamp; (3) Advanced Receiver Research 220VDA 220-MHz MOSFET preamp; (4) Advanced Receiver Research 432VDG GaAsFET preamp. The 608F was turned on and allowed to warm up for about one hour. The Boonton 92 was employed to measure output. Photo A shows the HP-608F up and running, while Photo B shows the 220VDA under test. To make sure of the operating frequency, the 608F has a separate output marked "UNCAL RF OUTPUT" which should be connected to a frequency counter for precise frequency measurements. I used a Ramsey Electronics 600-MHz counter, which is quite stable and accurate.

Instead of mentioning the manufacturer's claimed specifications for each of the preamps, I'll list my measurements in Table 1. The results might surprise you.

In each case, I started with a −20-dBm signal, or slightly more than 20 millivolts. Remember that the 1-dB compression point occurs when the input level must increase by 2 dB to result in the same gain at the output. For example, with the 220VDA this occurred when an input signal of −16 dBm, or 35 millivolts, was injected. The measured output was +1 dBm, yielding a gain figure of 17 dB. Signals of less than −16 dBm showed a consistent figure of 18 dB of gain as measured on the Boonton 92.

At this level, the preamplifier was saturated and going into compression. This is considered to be the point at which distortion products appear in the preamplifier's output—when it is no longer operating in a linear fashion. Spurious signals are generated along with the amplified signal, and IMD performance is degraded.

Note that both the Janel 50 PB and ARR 432VDG have very high compression points at +7 and +9 dBm, respectively. These preamps could no doubt be called "high-performance" and would work well in high rf density environments. The performance of the 220VDA is adequate, as is the MMG144 at +2 dBm. Incidentally, you should expect to see better than 0-dBm compression points

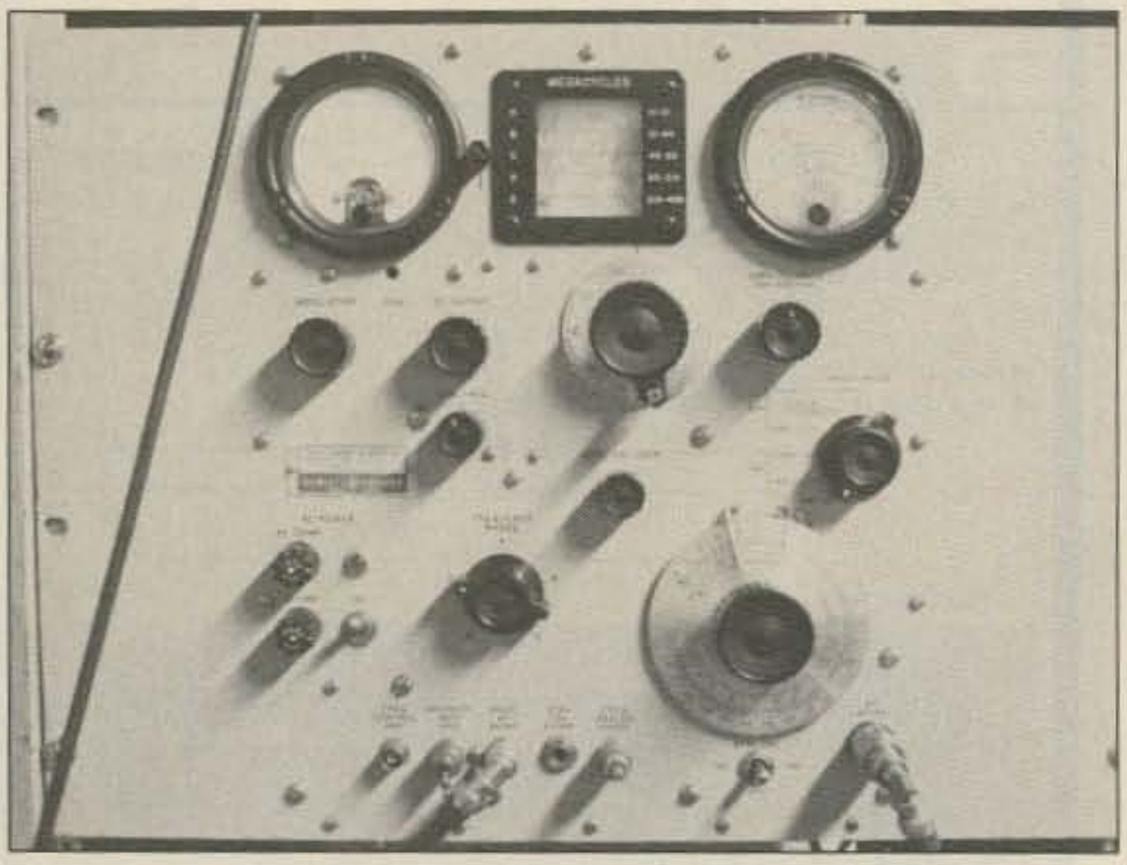


Photo A. Hewlett-Packard 608F signal generator in operation.

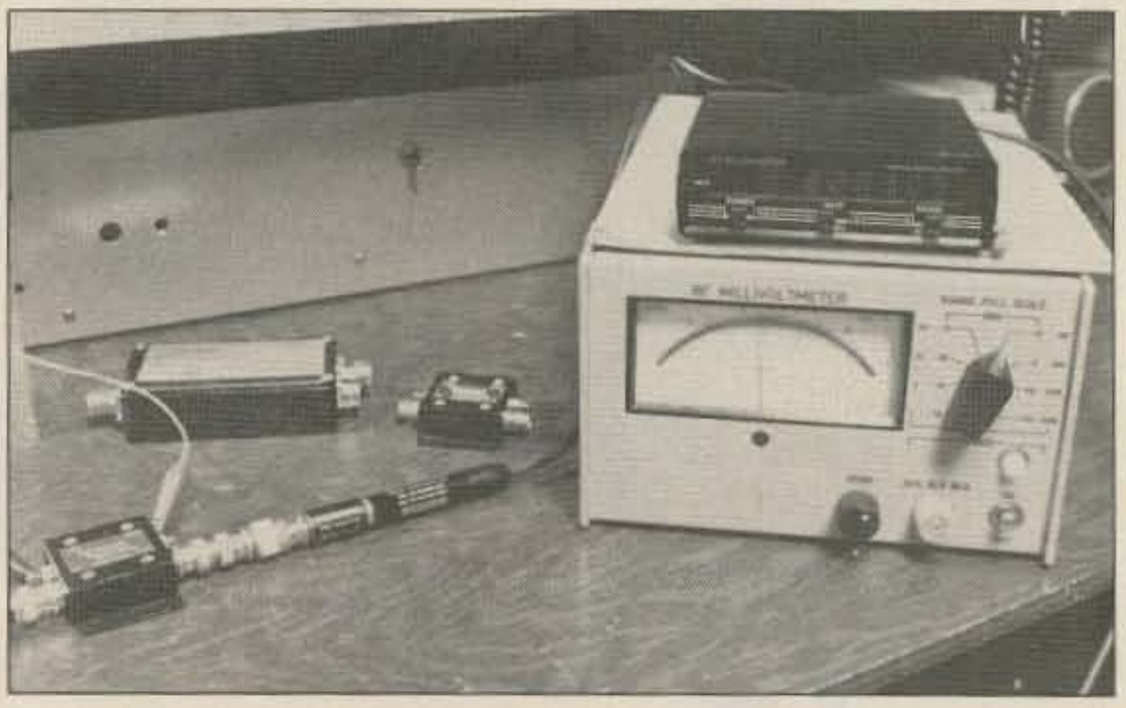


Photo B. 220VDA preamplifier under test with Ramsey counter and Boonton 92 millivoltmeter.

Model	Gain	1-dB COMP
Janel 50 PB	23 dB	+7 dBm
MM 144 VG	15 dB	+2 dBm
ARR 220VDA	18 dB	+1 dBm
ARR 432VDG	16 dB	+9 dBm

Table 1. Preamplifier measurements.

on any well-designed preamplifier! Avoid those units that cannot meet this specification, especially if you live in a high-rf area or do a fair amount of contesting.

In reviewing the measured data, it's interesting to note that the ARR 432VDG can accept a signal almost ten times stronger than the 220VDA before it goes into compression. The 23-dB gain figure for the 50 PB might sound a bit fantastic, but remember that the circuit employs a 3N204 MOSFET at 50 MHz, where gain and performance are a bit easier to come by. The compromise at higher frequencies is generally to run the semiconductor device throttled back a bit to improve the linearity. Many imported preamplifiers run excessive gain and "crunch up" easily as a result. A test I performed some months ago on an imported 220-MHz preamp showed almost 22 dB of gain but a 1-dB compression point of only −4.5 dBm, which is pretty poor performance. Sure enough, on-air tests showed all kinds of spurious mixing products from nearby channel 13 in New York City, making the preamp all but useless for weak-signal work.

Remember also that when you drive a high-gain preamplifier into the front end of your multimode or transverter, you could be exceeding the compression point of that radio's first rf stage! A sure sign of this is the presence of spurs up and down the band as well as strong local television or FM station signals punching through where they shouldn't be. It's good to keep some low-loss precision fixed attenuators on hand to put between the preamp and your VHF radio receiver input. Such attenuators are inexpensive and can be found at flea markets.

Other Handy Items

While at Kentronix, I also purchased another useful item common at flea markets: a Kay Electronics precision step attenuator, giving 101 dB total of attenuation using toggle switches in 1-, 2-, 5-, 10-, and 20-dB steps.

The attenuator is useful if you have access to only a low-level signal source other than a variable signal generator. Such a low-level source might be your two-meter hand-held in the low-power position! Since most hand-helds run under 500 milliwatts in low power, they make excellent signal sources for 144-, 220-, and 432-MHz measurements. The trick is knowing exactly how much power your hand-held puts out, and you'll have to make that initial measurement on some sort of calibrated lab equipment, or a commercially made low-power wattmeter. SSB Electronics makes a good low-power absorption-type meter for 50–1300 MHz with readings as low as 25 milliwatts.

Photo C. Close-up of leveling indicator on HP-608F. Output will remain constant from 10 MHz to 450 MHz.

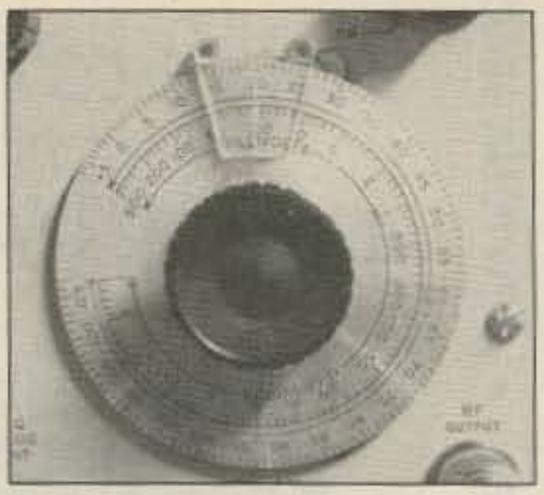


Photo D. Close-up of calibrated attenuator (piston-type) on the HP-608F.

Since the Kay attenuator allows 1-dB steps through 101 dB, the combination of it and your hand-held gives you a fairly accurate signal generator! (And it's cheap, too.) I use it in exactly that mode when I need a quick and dirty signal source for 2 meters, employing my IC-2AT at low power at 150 mW. Thus, starting with a signal of 150 mW, 101 dB of attenuation results in a signal of about 2 microvolts (uV). Add another 20–25 dB and you can get this down to under .1 uV, which is a very weak signal indeed. Receiver sensitivity can be figured quite accurately in this fashion, and if you can secure a millivoltmeter you can also make gain and compression tests with your hand-held.

That's it for this month. Hope some of you got on during the January VHF Sweepstakes to check out the station and make a few new grid-square contacts! I'll try to have a report in the April issue on my participation—wherever I wind up operating from! Until then, see you Above and Beyond!■

NK6K > PACKET

Number 22 on your Feedback card

Harold Price NK6K
1211 Ford Avenue
Redondo Beach CA 90278

HEADER WARS

There is a lot going on in packet this month, but unfortunately, most of it can be classified as short-lived phenomena. That's the type of thing where there is a lot of arguing going on now, but the fight will be over within a month ("now" equals mid December). If I write it up now, you won't see it until February, and you either won't care or it could start up the controversy all over again. Now I'm not one to stir up controversy for controversy's sake. . . but wait a minute, didn't I read something in "Wayne's Secrets to Success". . . yep, here it is—Rule 1: Be controversial. OK, here we go with "The Great Header War."

Because the fighting will hopefully be over by the time you read this, I'll fill you in on the background and why the issue is important. "Headers" refer to the information added to the front of a message as it is forwarded from one W0RLI (or compatible) BBS to another. These headers show the path the message took through the network. A sample set of headers is shown in Fig. 1.

Everyone has an opinion about headers. Each BBS operator (sysop) gets to specify what his header will look like. His personalized header will be placed at the front of every message that gets forwarded through his BBS. Some sysops like to see everything but the kitchen sink in the header. Here are some of the things I've seen in headers, ranked in no particular order:

1) Callsign of the BBS, with and without SSID.

2) Callsign of the originator of the message being forwarded.

3) Time and date that the message was received.

4) Time and date that the message was forwarded.

5) Time zone indicator—UTC, Z, EST, etc.

6) BBS's QTH given as city/state, grid square, latitude/longitude, or area (Balto/Wash or So-Cal, for example).

7) Frequency(s) used by the BBS.

8) The serial number of the message.

9) Any number of other personalizing notations.

With the possible exception of #4 (which can be assumed to be the same as the time the message was received at the next station) and #9, all of the above information can be useful to those who are trying to maintain the network. The headers serve to specify the backward path that the BBS operator at the receiving end must establish if he wants his users to be able to send replies in the other direction. In today's network, all of the routes are built by hand. Each sysop manually builds a list of BBS stations and how to forward to them.

For some BBS sysops, this is an easy job. They have only one other BBS that they can connect to, so traffic to any BBS but their own must obviously go to that other BBS. Some BBS operators can hit several other BBS stations, each of which has a set of BBSs they in turn can hit. Life is harder for these sysops.

Life is hardest of all for sysops who are in the same path as a prolific message sender. For example, WB6KAJ is right next to NK6K, and NK6K has sent a lot of traffic lately due to the packet poll. Almost all of the acknowledgments of poll responses that have

```
Msg# TR  Size To     From   @ BBS  Date   Title
2166  Y  1149 NK6K   N3BHA  NK6K   861202 packet survey response

R:861202/0436  S:861202/0540  WB7BNI #845 Phoenix, Arizona.
R:861202/1133z S:861202/1139z KE7CZ Dewey, Arizona (HF/145.01)
R:861202/1100z S:861202/1127z #6936 Via CENTEX Gateway W5XO Gause,Texas
N3BHA /W2HPM/11/Farmingville/NY/8612020523/r
N3BHA /W2JUP-4/5471/Farmingville/NY/8612020224/r
N3BHA /WA2SNA-1/ 4873/Hawthorne/NJ/8612020636z
Via WB2RVX: 1238 From N3BHA Rcvd 861130/0858z, Sent 861202/0639z
R:861130/0805z S:861130/0857z W3IWI # 6462 Balto/Wash [145.01/221.01]
R:861130/0441z S:861130/0730z K4NGC Woodbridge, VA (145.01/07)
R:861129/2117z S:861130/0513z WD4HXG   STERLING, VIRGINIA
<message  follows>
```

Fig. 1. The headers from a forwarded message.

```
From ihnp4!hoptoad!gnu@wbux2.UUCP Sat Dec  6 15:04:08 1986
Received: by ka9q.ampr.net (5.54/4.7)
id AA00919; Sat, 6 Dec 86 15:04:00 EST
Received: by sabre.bellcore.com;id 8612040158.AA07267
Received: by ihnp4.ATT.COM id AA16310; 2 Dec 86 08:24:58 CST (Tue)
Received: by hoptoad.uucp (1.1/SMI-3.0DEV3)
id AA01810; Tue, 2 Dec 86 04:54:05 PST
Date: Tue, 2 Dec 86 04:54:05 PST
From: hoptoad!gnu@ihnp4.UUCP (John Gilmore)
Message-Id: <8612021254.AA01810@hoptoad.uucp>
To: karn@ka9q.bellcore.com
Subject: Re: NK6K Packet Survey
In-Reply-To: your article <199@ka9q.bellcore.com>
Status: RO
```

Fig. 2. Headers from an ARPA mail message forwarded via KA9Q.

been sent from NK6K have gone out through WB6KAJ. There are 123 different BBS systems that I have sent messages to through WB6KAJ at some time in the past few months. Keeping track of all that by hand is a non-trivial task.

The first thought is to have your computer keep track of all this for you, right? It should be a simple task to look at the header in each message as it goes by, figure out the backward path, and update the routing file, shouldn't it? Well, it should be, but look again at Fig. 1. There are almost as many different combinations of information and methods of including it as there are headers. Writing a program to decode all that isn't easy, and wouldn't be reliable since sysops think up new formats every day.

You should now be able to see why the information is needed and why, even though it is there, it isn't readily accessible. Unless everyone includes a minimum subset of the needed data and presents that part of it in exactly the same way, we can't automate the route-building part of the network any time soon.

Until the headers are standardized, we can't solve a common user complaint either: "How come I have to look at 800 characters of trash to see a 40-character Happy Holidays message?" Since the headers are of primary importance to the sysop and only of secondary importance to the end user, many users have asked for a way to have the BBS strip off the "trash." Until there is a standard header format, there is no reliable way to separate headers from the message.

In the meantime, in November at least, sysops have been getting messages from other sysops, some threatening hellfire and damnation (or at least a pink slip from the FCC) if certain information wasn't added to the header. Other messages point out how messy your header looks and how you should clean up your act and align your fields. Others berate you as a channel hog for having too much information in your header (the same stuff that the first message told you to put in). It's always something. If you see messages coming to your local BBS with all the same header, you'll know that this problem worked itself out.

By the way, in case you thought this header business was unique to amateur radio, Fig. 2 shows the header lines from a poll response received in an ARPA mail message via a "real" network.

The Great Poll of 1986

As I write this, "the poll" continues to clog the airwaves. If you just got your subscription for Christmas, the December packet column featured a 46-question poll. I also made the questions available on a few packet and phone BBS systems. Respondents were encouraged to send the answers in via packet radio. The poll prompted even more response than I had hoped for. I've had 350 responses in the first three weeks. By the time you read this, responses will hopefully have dropped to a trickle, and I can begin analyzing the results. I'd like to get the numbers and commentary in the March *73*, but that may be pushing it.

Even though I haven't looked at the specific answers, the poll has already revealed a great deal. First, with the help of other interested hams and with no prompting on my part, the poll has found its way into a variety of other systems. Some analysis of the header information of the poll results not marked as "saw it in *73*" will tell us exactly how fast the word carried: It seems that we can get information dispersed to many parts of North America in a short time.

Next it shows that the ad hoc forwarding network, non-optimal as it is, can carry a worthwhile amount of data: 223,000 characters of information have come in already, with probably another 150,000 going out from me (mostly headers on short thank you messages). All this, in addition to the hundreds of other messages carried by the same network each day. Many of the messages came in via HF, which is not available 24 hours a day.

The large amount of messages sent to a single point has also pointed out some problems with the way we're doing things now. For example, when the local 14.109 HF forwarding node shut down as the control op left for the Thanksgiving holidays, messages to me were sent on some amazing journeys as systems and sysops tried to route around a down path. Messages originated in New England would bounce from the Midwest to Florida to Texas to Maryland trying to get to the West Coast. As the network gets smarter (or we do), these problems will diminish. I'll be making the raw header information available to those who want to do traffic analysis. Look for details when the poll results are announced.

Before I leave the subject of the poll, there were many comments along with the responses, both about the poll and about packet radio. I'll be putting some of those in the column as space permits in the months ahead. Thanks to everyone a month early, and especially to the forwarding BBS sysops who put up with all the extra traffic.

Pet Peeve

The one common "fault" I found in the messages as they came in was that some people never seem to enter a carriage return character <cr> when they enter text messages. They just keep typing. Either they have a program that wraps words on their screen or they don't worry about words split across line boundaries. While this can be less than pleasing visually for the guy on the receiving end, it causes problems for many software packages, and that's my major concern.

Most software deals in "lines." A line of data consists of the characters between one <cr> and the next. There will be a place in the program that says "read next line," where "line" is defined to be a buffer of some maximum size. This is sometimes 80, sometimes 140, sometimes 255 characters, but it is rarely infinite. When you enter a message and don't enter a <cr>, the whole message appears as one line. While it will wrap around to the

next physical line on most screens or printers, some programs will just toss out the characters that come after its internal line length.

This is usually a bad thing. For example, I've been taking the poll responses out of the BBS and putting them into separate files. I then read them into a larger file and do whatever cleanup is necessary with an editor. That editor has a nasty habit of tossing out anything past the 144th character on the line without so much as a by-your-leave. There are lots of ways around this little problem, of course, but the point is that during the formative phases of our network, it's nice to throw in a <cr> once in a while. Opposing viewpoints are welcome.

HF Life Above 20 Meters?

One of these days, we're going to see sunspot activity pick up again, and the HF bands above 20 meters will be useful for longer periods of time. Some packeteers are getting ready now. Here's a message sent to me by Ray WA6OWM:

"I have been on 28.093 and 21.093 the last three days from 1800–2400 UTC. Tuesday, 11/26/86, was the best day for 10 meters. Worked 10 stations in the following states: FL, PA, NH, KY, and AR. 15 meters has been a bit better, only because propagation hits that band twice during the period. Lots of fun for those on. I also run a Propagation Forecast Program, Minimuf, from *QST*, December, 1983. Openings to each station correspond to Minimuf, within 3 MHz. So far no DXCC stations. Through the winter I'll leave a beacon on 28.093 for those interested. Pat KR5S and I ran some tests on 3.636 MHz last night. Signals were 10 to 20 dB over S9, but noise was bad (S7 to S9 level). Caused signals to be somewhat distorted."

TEXNET

As I wrote last month, I went to the AMSAT general meeting in Dallas. While there, I was asked if I wanted to see a running TEXNET node. TEXNET is a network protocol that has been in development for a year or more in the Dallas area. I predicted a while ago that they would be the first people up and running with more than just one or two connected nodes because they weren't spending time trying to convert anyone to their way of thinking; they were just getting on with the implementation. Well, they are up and running with four or more nodes in the Dallas area. But I think it's time they came out of the back room and told the rest of us what's up.

As I was saying, I was asked if I wanted to see a running node, and I said, "Sure." While I was not quite blindfolded, two of them, one techie and one muscle-type, did take me outside and on a furtive quarter-mile hike through a parking lot. In the very last row was a nondescript hatchback with some equipment hidden under a sheet. They told me to get in. The sheet was removed and tacked up over the windows even though it was at least 105 degrees in there. The techie got in with me while the muscle stepped back to keep an eye on things. This is all true. Really! I was then handed a laptop computer and given instructions on how to access the local TEXNET node.

I connected a standard AX.25 TNC to the node, and then talked to that node to issue a second connect request to establish a path to another user through a second TEXNET node. The node I was connected to used a homegrown datagram protocol to converse with the other nodes. In a moment, a regular AX.25 connection was established between the distant TEXNET node and the user I wanted to talk to. From that point on, my local node acked packets from my TNC, and the other user's local node acked his packets. Getting packets between the two nodes was handled by the TEXNET protocol.

They also showed me a conference bridge. Several users can establish a regular AX.25 connection to the bridge; the conference bridge routes each data packet to all of the other connected users so that everyone sees what everyone else sees. Everyone sends to the bridge and gets his acks from the bridge.

After about 10 minutes, the sheet was pulled back over the gear, and I walked the quarter mile back to the hotel alone. I'll try to get more information on all this, but in the meantime, if you know a Texan, try to pressure him to publish.

Last month, I was on my way to Boston. I didn't sleep that night. Tomorrow I have to go to San Jose, but this time I started writing earlier in the day. Next month, packet poll results, maybe.■

SPECIAL EVENTS

MARSHALL ISLANDS
JAN 31–FEB 9

The Kwajalein ARC will operate KX6BU from 0600 UTC January 31 until 0600 UTC February 9 to commemorate the 43rd anniversary of the Battle of Kwajalein and Roi-Namur. Frequencies: SSB—14.250, 21.350, 28.550; CW—7.025, 14.050, 28.050. For $6, KX6BU will issue a QSL, certificate, and a 64-page book on the battles of Kwajalein and Roi-Namur. Three dollars will bring the QSL and certificate. Send all requests to KX6BU, Box 444, APO San Francisco 96555-0008.

CLARK GABLE BIRTHPLACE
FEB 1

The Harrison ARC will operate special-event station N8TF on February 1 from the birthplace of Clark Gable. SSB operation will be on approximately 3.875 and 7.230 MHz from 1400–2200 UTC. For a special QSL, send QSL and SASE to KC8XS, PO Box 362, Cadiz OH 43907.

GROUNDHOG DAY 100TH
FEB 1–2

The Punxsutawney ARC will hold a special event on February 1 and 2 to commemorate the 100th anniversary of Groundhog Day. Special-event station W3QOS will operate on February 1, from 1300 to 2200 UTC, on 14.235 and 7.235. Special-event station K3HWJ will operate on February 2, from 1300 to 2200 UTC, on 7.235. Certificate for SASE to W3QOS, PO Box 20, Big Run PA 15715.

W. CANADA WINTER CARNIVAL
FEB 6–15

The North Okanagan RAC will operate special-event station VE7NOR on February 6–15 to commemorate western Canada's largest winter carnival. Frequency: 14.230 every afternoon. For a commemorative certificate and QSL, send log info and $1 or two IRCs to NORAC, Box 1706, Vernon BC V1T 8C3, Canada.

TRAVERSE CITY MI
FEB 14

The Cherryland ARC will hold its 14th annual Swap N Shop on February 14, from 8 a.m. to 2:30 p.m., at the Immaculate Conception Middle School gymnasium, 218 Vine Street, Traverse City, Michigan. Admission $2.50, tables $3 each. Talk-in on .52 and 146.85. For more information, contact Mick Glasser N8DBK, 4102 Peninsular Shrs. Drive, Grawn MI 49637; (616)-276-9203.

MANSFIELD OH
FEB 15

The Mansfield Mid-Winter Hamfest/Compter Show will be held on February 15, beginning at 7 a.m., at the Richland County Fairgrounds in Mansfield, Ohio. Tickets $3 in advance and $4 at the door. Tables $5 in advance and $6 at the door. Half tables are available. Talk-in on 146.34/.94. Advanced ticket/table orders must be received and paid by February 5. For additional information or advanced tickets/tables, send SASE to Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905, or phone (419)-589-2415 after 4 p.m. EST.

LONG ISLAND NY
FEB 15

LIMARC will sponsor the Long Island ARRL indoor hamfest on February 15, beginning at 9 a.m., at the Electricians Hall, 41 Pine Lawn Road, Melville, Long Island, New York (at Exit 49, north of the LIE, go north a block to Pine Lawn Road, turn right to site). Admission for buyers is $4 at the door and $3.25 in advance with SASE (checks to: LIMARC Tickets, Mark Nadel NK2T, 22 Springtime Lane East, Levittown NY 11756 by February 5). Sellers: 4' x 6' tables are $12 each or bring your own at $1.50 a foot with an $8 minimum. Each table sale admits one person, additional workers at $3.25 each (checks and reservations to: Hank Wener WB2ALW, 53 Sherrard Street, East Hills NY 11577). Make all checks payable to LIMARC. LIMARC VHF rig clinic will be on hand. For additional information, call Hank at night at (516)-484-4322.

LOST DUTCHMAN DAYS
FEB 20–21

In commemoration of Lost Dutchman Days, Superstition ARC is offering a certificate to those who work WB7TJD in the 40-, 15-, or 10-meter Novice bands, or in the lower end of the 40-, 20-, or 15-meter General phone bands on February 20–21. CW operators should listen for "CQ LDD." Hours are 1500–2400 UTC both days. Please QSL with either a 9 x 12 SASE with 29¢ postage or, if you don't mind it being folded, a business-size 22¢ SASE. Please include your QSO number on your QSL and mail to SARC, PO Box 1551, Apache Junction AZ 85217-1551.

SALEM OR
FEB 21

The Salem and Oregon Coast Emergency Repeater Associations will sponsor the 1987 Hamfair on February 21, beginning at 9 a.m., at the Polk County Fairgrounds. Admission is $4 in advance or $5 at the door. ARRL/VEC testing. Talk-in on 146.26/.86. For more information, write to Salem Repeater Association, PO Box 784, Salem OR 97308.

MEDINA MN
FEB 21

The Robbinsdale ARC will sponsor its 6th annual Mid-Winter Madness Hobby Electronics Show on February 21, from 8 a.m. to 2 p.m., at a new site, the Medina Ballroom, Hwy. 55, 3-1/2 miles west of 494, in Medina, Minnesota (western suburb of Minneapolis). Admission is $3 in advance, $4 at the door. $8 for 8-foot table (half tables for $4). FCC testing ($4) begins at 9 a.m., limited walk-ins. Talk-in on 147.00 and 146.52. To register, send SASE and fees to Robbinsdale ARC, PO Box 22613, Robbinsdale MN 55422, or call Bob at (612)-533-7354. Send exam registrations to Ron Schulz NAØU, 6308 Peacedale Avenue, Edina MN 55424 by January 21.

LIVONIA MI
FEB 22

The Livonia ARC will hold its 17th annual Swap 'N' Shop and Computerfest on February 22, from 8 a.m. to 4 p.m., at the Dearborn Civic Center in Dearborn, Michigan. ARRL/VEC FCC amateur examinations will be given by the Motor City Radio Club. Plenty of tables are available. Reserved table space of 8-foot minimum available. Talk-in on 144.75/5.35 and 146.52. For further information, send a 4 x 9 SASE to Neil Coffin WA8GWL, c/o the Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

CUYAHOGA FALLS OH
FEB 22

The Cuyahoga Falls ARC will sponsor its 33rd annual Auction-Fest on February 22 at the Tallmadge High School (1 mile east of Tallmadge Circle on East Avenue or 2.3 miles west of I-76 at Exit 31). Flea market opens at 8 a.m. and the auction begins at 11 a.m. Admission is $4 at the door and $3 in advance. Flea market tables available for $6 in advance. Deadline for tables is February 9. Talk-in on 147.87/.27. For more information, send an SASE to Cuyahoga Falls Amateur Radio Club, PO Box 614, Cuyahoga Falls OH 44222.

BROOKSVILLE FL
FEB 28

The Hernando County ARA will hold a hamfest on February 28 at 205 Alpine Street, Brooksville, Florida. Admission is $3 at the door, $2 in advance. Swap tables cost $6. Send check and SASE to PO Box 1721, Brooksville FL 33512. Examiners will be present to give Technician- through Extra-class licenses. Talk-in on 146.715. For more information, write to the above address or call (904)-796-4840.

NORWICH CT
FEB 28

The Radio Amateur Society of Norwich is sponsoring an auction at the Montville VFW Hall. Directions: Rte. 395 to Exit 79 to Rte. 32N, about 1-1/2 miles to left at Raymond Hill Road, 1/4 mile on right in back of the Wonder Bread Store. Talk-in on 146.730/146.130. Set up at 9 a.m. The gavel drops at 10 a.m. Contact KA1IFG at (203)-848-9670 for more information.

PLAINWELL MI
MAR 1

The 1st annual State Technical Institute Hamfest will be held on March 1, from 8 a.m. to 4 p.m., at the school grounds at 33 Alber Drive, Plainwell, Michigan (located 15 miles northeast of Plainwell on Pine Lake). Admission is $2. Single tables $3. VEC examinations given. Talk-in on 146.46. For information and table reservations, write to Robert Mousseau KA8VVM, State Technical Institute, 33 Alber Drive, Plainwell MI 49080, or call the school at (616)-664-4461.

WINCHESTER IN
MAR 1

The Randolph ARA will sponsor the Randolph Amateur Radio Hamfest on March 1, from 8 a.m. to 3 p.m., at the Winchester National Guard Armory. Admission is $3 in advance, $4 at the door. Children 12 and under free with adult. 3' x 8' table space $5 (tables limited); space only, $3. Electronics and amateur radio exams. Talk-in on .90/.30 and 224.90/223.30. For more information, contact RARA, c/o Kedrick Robbins W9QUH, Rte. 1, Box 389, Parker City IN 47368; (317)-468-6568, or Jake Life W9VJX, 407 High Street, Winchester IN 47394; (317)-584-9361.

ATV

Number 14 on your Feedback card

Mike Stone WBØQCD
PO Box H
Lowden IA 52255

NEW *73/SPEC-COM*
WAS SSTV CONTEST
FEB. 23–MAR. 1

Let's get slow-scan TV moving again! This past fall and winter have taken their toll, with low activity levels on SSTV around 14.230 MHz and elsewhere. Today's modern-style color converters have discouraged some black-and-white operators from staying active.

With spring just around the corner, the *Spec-Com Journal* will be sponsoring its annual Worked All States SSTV Contest, the only regularly sponsored SSTV contest by any video group for many years. The 1987 WAS Contest will be jointly supported by *73* Magazine and *Spec-Com* for the biggest anticipated turnout ever.

The week-long contest operating period will allow contestants to send pictures of themselves and their shacks and to "enjoy" each visual exchange, rather than fighting for a quick contact and proceeding on to the next station, as is usually the case in 24- or 48-hour weekend contests.

Contest Specifications

1) Work as many U.S. slow-scan TV stations as possible on HF or VHF during the week-long period from 0001 UTC February 23 to 2400 UTC March 1, 1987. The idea is to work all 48 continental U.S. states plus three U.S. possessions.

2) Each initial contact with one of the continental 48 states gives you 100 bonus points. An extra 50 points is awarded for *color* two-way contacts.

3) Contacts with Alaska, Hawaii, and Puerto Rico receive an additional 500 points.

4) Only one contact per station is allowed on the entry form.

5) SSTV picture contacts may be initiated by SSB voice, but the sending station's callsign and RSV signal report must be in true video (analog) format to qualify as a legitimate contact.

6) Keyboard- or computer-generated graphics are acceptable for giving ID and signal-report information.

7) Any SSTV picture mode speed format may be used, such as 8, 12, 17, 24, 25.5, 34, 36, or 72 seconds.

8) High resolution is recommended, but not mandatory for point scoring.

9) Use standard SSTV operating areas on all available bands (28.680, 21.340, 14.230, 7.220, 3.845, etc.). The use of SSTV on 160 meters is now legal. Please avoid the Saturday afternoon 14.230-MHz W1JKF/W9NTP International SSTV Net at 1800 UTC, except perhaps to make short voice contacts with another station in a needed state via Net Control and to QSY to another frequency at the conclusion of the net. Operating on 14.230 to 14.240 is recommended during this contest.

10) Include on your log sheet: Your station callsign and operator name; a list of states in alphabetical order (including Puerto Rico), followed by the callsigns and dates of contact of stations worked from that state; and the number of states worked, the band used, and your final score.

Contest entries must be postmarked by March 10, 1987. Mail to: WAS SSTV Contest, PO Box H, Lowden IA 52255. The official results and standings will be jointly published in *73* and *Spec-Com Journal*. Certificates will be presented to all entrants and winners. A Worked All States SSTV Map will also be sent to you for two 22¢ stamps (no SASEs).

"Blow the dust off those P7 tubes, amigos, and let's hear some shrilling tones!"

ATV Fun

Fun, education, and fellowship—that's what our great hobby is all about, isn't it? It's certainly no less on the ATV modes. You can have a lot of fun DXing, or working on CW, RTTY, EME, OSCAR satellites, and packet radio—but how about one mode that has all these interesting traits and more?

On fast-scan UHF TV, you have all the thrills of DXing on 432 SSB or EME by making schedules and trying to work that fella three or four states away on your TV screen. The thrill I experience on each band opening when I see those first long-distance DX signal sync bars or a locked "viewable" picture hitting my antennas is simply indescribable!

The memories of watching powerful black-and-white and color TV signals coming from W9ZIH or N9AB out of the Chicago area some 180 miles away, or from K9WZB or W9NTP in Indiana. Or the exciting P3 pictures from WB8ELK and WB8ZAR in Ohio (more than 400 miles away!). Or getting that phone call late one summer night from Bill K9KKL in Springfield, Illinois, and then I turn on my TV set and see him closed-circuit on my screen. All these are etched in my circuit boards forever!

The times that Dave WBØZJP in St. Louis, Missouri (250 miles), and I just sit in our chairs, having a good ole fashion rag-chew for several hours at a time "live and in color." The unprecedented 1 to 4 a.m. fascinating FSTV QSO with Jeff KA9TGX in Lafayette, Indiana—where we "waited out the band" and watched our initial P2 "two-way" pictures become absolutely P5; then we concluded our unique achievement by toasting each other with a "cold one" right on the tube, only to get a few hours of sleep and go back on at 7:30 a.m. to "see" each other off to work. Boy, what memories! All, of course, stored on videotape!

Seeing that first SSTV pic-

Photo A. VE6WSJ and VE6SL SSTV shack demonstration area. Photo by John VE6COD.

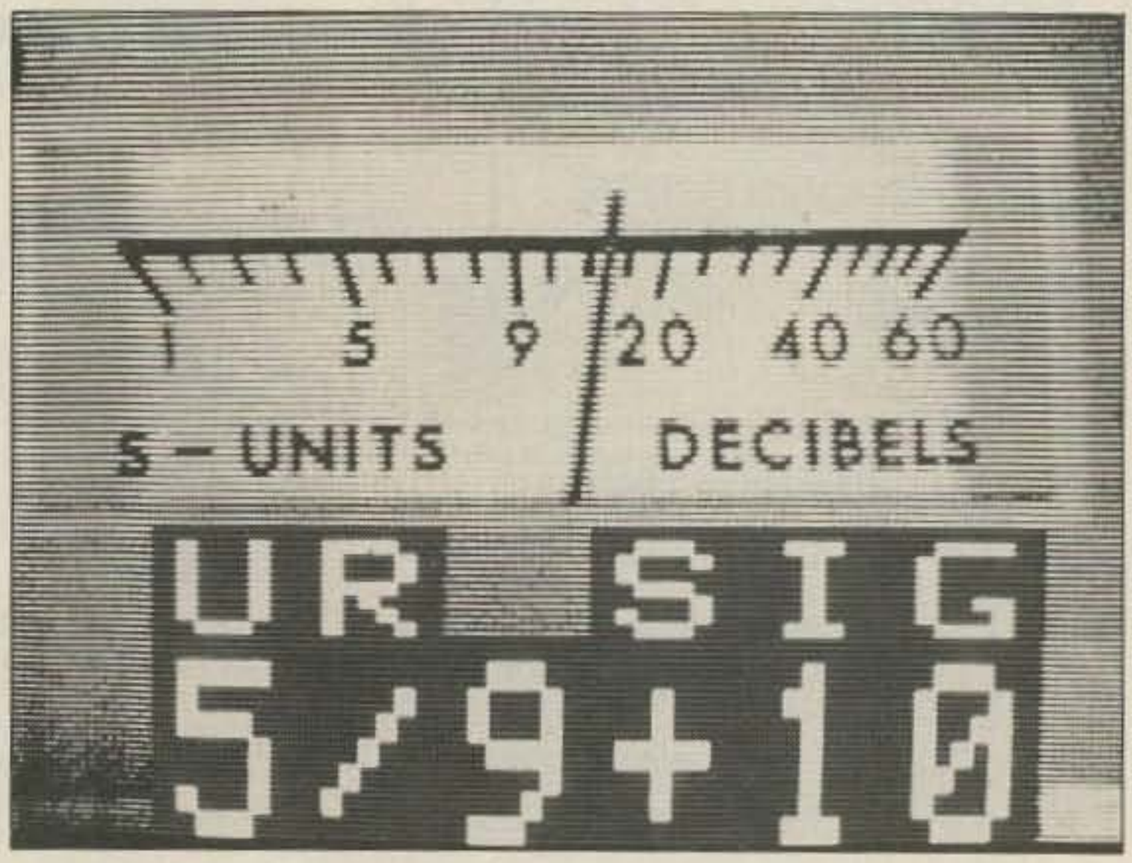
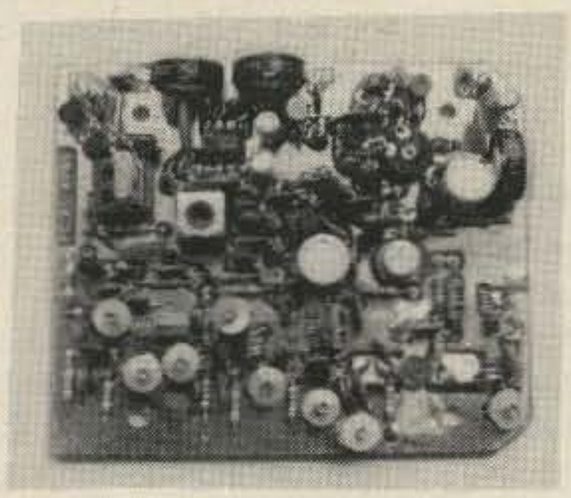


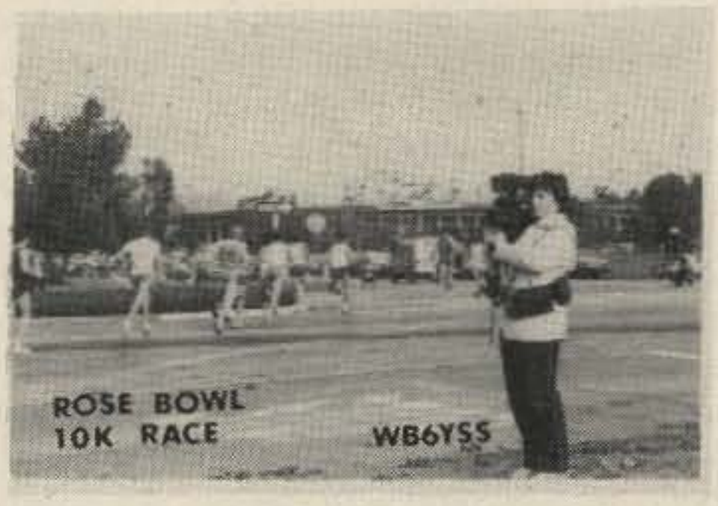
Photo B. Captured meter report on SSTV with station I3XQW.

P.C. ELECTRONICS 2522 S. PAXSON LN. ARCADIA CA 91006 (818) 447-4565
TOM W6ORG MARYANN WB6YSS

ELECTRONICS

THE "KREEPIE PEEPIE" ATV TRANSMITTER





KPA5 1 WATT ATV TRANSMITTER BOARD FEATURES:

★ 1 watt pep minimum RF output on sync tip.

★ Full color and sound on one small 3.25 x 4" board.

★ Composite video input from camera, VCR, etc.

★ Runs on external 13.8 vdc at 300 ma supply or battery.

★ Wired and tested board covers 421 to 439 mHz.

★ Supplied with one xtal on 426.25, 434.0, or 439.25 mHz but capable of 2 freq operation with the addition of 2nd xtal (add $15). Other 70cm freq. available on special order.

★ Mic input from a low Z dynamic and line level audio input found in most portable color cameras, VCRs, or home computers provided.

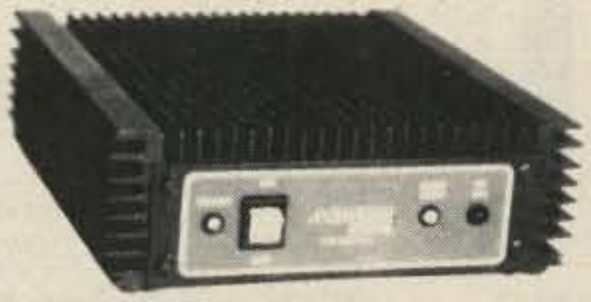
★ Schematic and application notes supplied for typical external connections, packaging, and system operation.

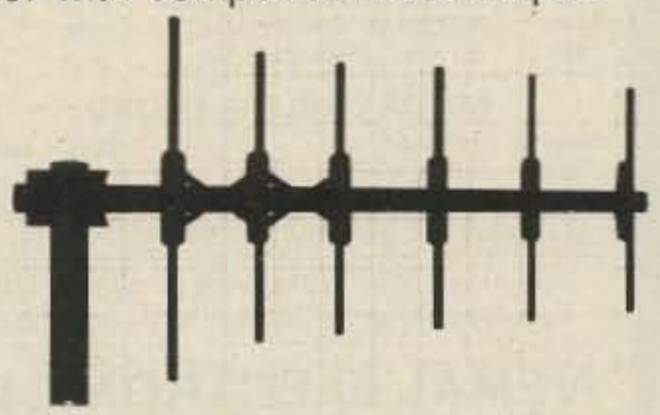
★ Price delivered via UPS surface in the USA is only **$159.** Technician class amateur license or higher required for purchase and operation.

DO SOME OF THESE APPLICATIONS INTRIGUE YOU?

1. PORTABLE CORDLESS TV CAMERA. No heavy VCR to lug around or cable length limitation. You can even use your home VCR rather than a portapak. Now you can creep around and peep thru your camera more easily. Gives good pictures up to a mile with simple whip, and 40 miles using beams in flat terrain.
2. MOBILE OR PORTABLE ATV for public service events such as races, parades, marathons, etc. A Mirage D24 40 watt amp can be added for greater mobile coverage or base operation. Mount in an airplane for CAP and rescue searches for an eye in the sky.
3. REMOTE CONTROL OF R/C AIRPLANES or ROBOTS. Fly with a camera in the nose to control as if you are in the plane. Likewise a robot can now be out of site of the operator.
4. REPEATER SITE SECURITY OR COMPUTER VIDEO DISPLAY. Turn on thru your repeater a camera at the site to see the area, weather, read meters, or if a computer is used, show status, play games, etc. by remote control. With all the new technology using TV displays, it is natural for hams to adapt these new products to transmission over the air. What applications come to your mind?

WHAT IS REQUIRED FOR A COMPLETE OPERATING SYSTEM? Either a **TVC-2G** or **TVC-4G** downconverter connected to any TV set tuned to channel 3, and coax cable to a good 70cm antenna to receive. Package up the **KPA5**, add 12 to 14 vdc, antenna, and any home TV camera, VCR, or computer with composite video output. **SIMPLE, EH?**





ACCESSORIES:

TVC-2G GaAsfet downconv. board wired & tested..**$59**
varicap tuned, 420-450 MHZ to ch3. Req 12vdc
TVC-4G (TVC-2G in cabinet with 120vac supply)...**$99**
TVCX-70 crystal controlled GaAsfet downconv.....**$99**
specify in freq. & out on ch3 or 45mhz IF. 2 freq..**$114**
Hammond 1590D Use for KPA5. 7.3x4.7x2".....**$17**
1590C 4.6x3.6x2" aluminum box. Fits TVCX-70..**$11**
800J 10 pin VHS color camera chassis connector....**$10**
VOR Video (horiz sync) operated relay board.....**$25**

ALINCO ELH-730G 1 in / 20 out all mode amp...**$129**
MIRAGE D24N-ATV 1in / 50 out all mode amp....**$219**
450 ISOPOLE omni 4dbd vert. gain antenna.....**$65**
KLM 440-6 8dbd, 60 deg. beamwidth antenna.....**$62**
KLM 440-14 11dbd, 48 deg. BW antenna.....**$77**
KLM 440-27 14dbd, 36 deg. BW antenna.....**$111**
SAXTON 8285 100ft 50 ohm coax 3.5db/C loss...**$41**
COLUMBIA 1180C 100ft coax, 2.5 db/C loss.....**$59**
UG21 type N male connectors for larger ID coax.....**$5**

↩28

ture paint down on my monitor screen was yet another ATV thrill. Seeing one paint down a few years later in color was even bigger excitement!

The neat pictures I received from ZS6BQT, ZS6BTD, ZS2AD, and 5N0DOG in Africa, as well as those from G3WW, KP4YD, LU4DGN, VK5RM, ZL1BLV, ZL2FR, OH2KM, JA1JRK, ON6DI, and many, many others, mean more to me than just another log-book entry or a QSL card.

The HF FAX contacts to Luxembourg; the SSTV reception letter from a shortwave viewer in Russia; the enjoyable multi-time slow-scan TV contacts with VE6PW, K6AEP, WB1ADZ, K4TGC, and others; the everyday FSTV QSOs and exchanges with the "local" crew—all these have played an important and very enjoyable part of my life. Ham radio and ATV are NOT just a hobby. They are an obsession.

Special Effects

Computers are used a lot on ATV, and the radio amateur who has not yet jumped into small personal computers is quickly becoming a relic of the past. Computers make great low-cost color bar and character graphics generators, and they will let you add special effects to operating modes and communicate over the airwaves just by pushing the right keys. They have opened up a whole new income potential for my low-profit business by helping me earn extra money in writing and modifying software programs.

The "photography" experience I have gained using cameras—learning how to get the best lighting out of the ATV shack or that hard-to-shoot color SSTV picture closeup—is invaluable. My many hours of VCR tape editing and programming assembly have led me to better appreciate things like TV special effects, commercials, documentaries, and what actually goes into making a movie.

My association with our local ATV group has taught me maturity in dealing with people, responsibility in doing things that I say I will accomplish, and everyday lessons in electronics—all because of ATV.

Before I move on to the next subject, I hope my thoughts about the "fun, education, and fellowship" that I have had on amateur television will demonstrate to YOU that getting on ATV is more than just sending pictures and making contacts. The mode itself will become a warm, new part of your life! It would be a shame to miss out on it.

ATV Info

The new 1987 ARRL *Handbook* has been out now for a few months. I mention it, at the risk of raising Wayne Green's blood pressure, because Bruce Brown WA9GVK/4 of the Washington DC Metrovision ATV group has once again done a superb job in writing and assembling chapters on visual communications. His presentation on FM TV was very thorough and should be commended. His time and work get fellow amateurs—many of whom he will never meet—interested in and on ATV. He is quite a positive credit to our hobby. Thanks, Bruce!

Don Miller W9NTP and Tom Hibben KB9MC are about ready to come out with their latest *SSTV Handbook* published by the League. Look for it!

N0HAV has a 20+ program disk package for you Commodore nuts. We have several similar versions for TRS-80C nuts. An SASE gets the information on both.

This year at Dayton, *Spec-Com* will be releasing the first ever USATVS North American ATV directory. It will list all USATVS members—the mainstream of fast- and slow-scan TV operators in the United States, Canada, and Mexico—as well as foreign members. We will try to include other active ATVers as well. Also to be presented is the latest ATV repeater roster, a 2-meter auxiliary audio channel map, a signal P chart, and a special section on organized FSTV groups and clubs around the country.

Spec-Com also offers an updated version of our famous CoCo-Radio TRS-80C Color Computer program. It is a collection of more than 30 programs, including FSTV, SSTV, RTTY, CW, FAX, OSCAR, TVRO, and other material, all of which needs no expensive interface requirements between your Radio Shack Color Computer and your HF receiver. Send an SASE, and we will give you the details.

Pass along the word about the *73/Spec-Com* WAS SSTV Contest—February 23 through March 1. Blow the dust off those P7 tubes, amigos, and let's hear some shrilling tones! ■

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In our continuing effort to present the best in amateur radio features and columns, we've decided to go directly to the source—you, the reader. Articles and columns are assigned Feedback numbers, which appear on each article/column and are also listed below. These numbers correspond to those on the Feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

"What's in it for me?" comes the cry from our faithful readers. Besides the knowledge that you're helping us find out what you like (and don't like), we'll draw one Feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save some money on stamps, why not fill out the Reader Service card, the Product Report card, and the Feedback card and put them in an envelope. Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 22 cents!

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Congratulations to **Larry Price** of Puyallup, Washington, this month's winner of a one-year subscription.

LOOKING WEST

Number 19 on your Feedback card

Bill Pasternak WA6ITF
28197 Robin Avenue
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REPEATER OPERATION: U.S. VS. EUROPE

The other night, I sat down to write an article solicited by my friend Kris Partridge G8AUU. As you can note by his callsign, Kris is a resident of the United Kingdom, more properly, of Teddington, a London suburb. The story of how we met is an interesting one, and also an important one for this month's column.

It was in late 1981 when I received a note from another British amateur who was also destined to become a friend. Andrew Emmerson G8PHT had been given my name by our mutual friend Tom O'Hara W6ORG of PC Electronics. Andrew is an avid ATVer and also a collector of certain vintage broadcast television gear. He was specifically looking to find some old "Indian head" iconoscope tubes for his collection, and he had written to solicit my aid. Well, I had some leads on an iconoscope or two, none of which ever panned out. But in the process of writing to one another, we realized that we had a lot in common.

Since Andrew was a "G8" with no HF operating privileges, we were unable to hold on-air QSOs. Instead, we began to exchange "audio letters" recorded on tape cassette. In one of his cassettes during 1983, Andrew told me to expect a phone call from his friend Kris Partridge who was touring the United States and Canada. A few days later, I was awoken by a rather cheery-sounding voice over the phone that introduced itself with the callsign G8AUU.

It was election day 1983, and I knew that I would be working quite late that evening with our station's news department, which would be broadcasting live election updates "on the half hour" throughout the evening, continuing until the most important races had been decided. As the "department of one" responsible for their electronic news-gathering gear and on-air videotape playback facilities, I was required to stay on as well. I asked Kris to meet me for dinner and then hang around for a few hours, as I expected it to be a fairly "normal," albeit long, night's work.

I had only recently rebuilt the edit suites with the latest in BVU-800 U-matic VCRs from Sony Broadcast, and so I expected few problems with that gear. A few cameramen stopped by to get the heads of their portable field recorders cleaned, and one BVU-50 managed to snap a loading linkage belt. The part was in our stock, so the operator was quickly redispatched to political points unknown. There were the regular problems with some of the very old VCRs that we were using to record incoming feeds, but no real emergencies.

I was grateful to have Kris as a visitor, since nobody else working the swing shift had an interest in ham radio as well as in the broadcast industry. As it turned out, G8AUU was almost my counterpart for a television facility in the United Kingdom.

Kris and I talked about many things, and eventually the subject turned to FM and repeater operation. As we began exchanging ideas, I realized that it would be a formidable task to ever try to explain the way in which the amateurs of North America have developed their FM and repeater operations.

I learned from Kris that in most other parts of the world that permit FM and repeater operation, there is no such thing as "getting a repeater pair from a local frequency coordinator." In fact, the Radio Society of Great Britain technically holds the licenses to all repeaters operating in the United Kingdom. Can you imagine if the ARRL held the licenses to every repeater in the United States on direct order of the FCC? That's basically the way it is all over the world. Individuals and clubs own only the hardware, not the license!

For a group anywhere in England wanting a repeater, it is a long and arduous process to get a permit, even though the RSGB has a special section that's dedicated to only that purpose. The RSGB isn't what's slow; it's the British Department of Trade and Industry, their FCC. The same is true in many other western European nations as well. In most cases, getting a repeater on the air means working with and through the national amateur radio society.

And then there's the dichotomy that all European repeaters are "open systems" by their standards, but are "closed systems" by ours. This is because almost all western European nations require that you have a tone encoder in your radio to bring it up. This tone encoder is not the familiar CTCSS or PL™ that we use here; it's the older "tone-burst" system that was phased out of use in most of North America when 15-kHz splitsplits came along in the early 70s. Some governments even dictate the tone frequency and the burst-length/duration. Our conversation proved that while two men can speak the same language, they do not always mean the same thing.

"The Radio Society of Great Britain technically holds the licenses to all repeaters operating in the United Kingdom."

Luckily for me, Kris was well aware of the vast number of repeaters in the United States and of the basics of our voluntary coordination process. As it turned out, he and Julian Baldwin G3UHK are the people who compile and produce *The International VHF FM Guide*. This is a softcover/hardbound 66-page book that covers all known repeater and FM activities worldwide. Its current edition, edition 6, contains lists of repeaters in 48 nations, an overview of operations in the United States and Canada (there was no room to print a list of almost 10,000 North American repeaters), and information on licensing in the nations covered. It would probably be very handy to any U.S. or Canadian ham planning a trip abroad.

While I was on the phone with Kris the other day, we happened onto the subject of the book, and I asked if he and Julian were planning an update. I should learn to keep my mouth shut, because within the winking of an eye, I found that I had committed myself to writing an explanation of North American FM and "relay" operation for their next revision. As this column goes to press, I am still at work on the project, and I can tell you that it's no easy chore.

Unfortunately, one cannot explain away the highly volatile and exceedingly political world of North American FM, repeaters, and other relay devices on a purely technical level. Unlike the remainder of the world, we "run our own shop," so to speak. So, how does one explain a "simplex autopatch" to a world of FM enthusiasts whose governments prevent them from having any type of phone patch or autopatch? How do you explain the difference between "closed" and "private" repeaters to a world where tone access is commonplace and all repeaters using it are "open"? How do you make those who have no concept of our standards understand that this difference is "political and operational" rather than "technical," especially when their system of repeater licensing precludes the politics that we have become accustomed to. How do I explain why in the United States in the upper 2 MHz of the two-meter band we use three divergent band plans, all of which have the blessing of our national society, the ARRL?

In most parts of the world, a nation's amateur radio society is looked upon in the same light as is that nation's agency that governs communications. For example, in the Netherlands, there are about 12,800 hams. Of these, over 12,000 are members of the Dutch national amateur radio society, the Veron. In the United States, there are almost 450,000 licensed hams, but only about 160,000 of them belong to the ARRL. But here in the United States, hams are not forced to go to the ARRL to get a channel pair for their repeater. Nor are they forced to go to the ARRL to take their amateur test, unless they desire to do so.

I still cannot help but wonder what other hams around the world will think when they read what I write about FM and repeaters in this part of the world. Will they understand all of the political chicanery? I doubt it. Will they think us fools? Who knows? Will they envy us our freedom of choice? That I think they maybe will.

One big change that is planned for the next edition of this guide is the inclusion of information on

packet operations around the world. If enough information can be garnered, Kris says that they will devote a separate section to it. Also needed is information on voice repeater operations from any nation, but particularly from Central and South America. The last edition carried listings only from Argentina, Brazil, Chile, and Mexico from that part of the world.

You probably want to know two things right now. Those of you planning a vacation to Europe must be wondering where you can get a copy of the current edition. Right? Well, that's easy. The cost is listed at £2.10 UK, which is equivalent to $3.25 in U.S. funds. I suggest that you write to Julian Baldwin, 41 Castle Drive, Maidenhead, Berks, SL6 6DB, England, to ascertain if this price is still correct. If you are outside of North America and want to provide information for the revised version of *The International VHF FM Guide*, send it either to Julian at the address above or to Kris at 6 Blagdon Walk, Teddington, TW11 9LN, England.

FUJI REVISITED

In November of last year, I told you about the mini-brouhaha that appeared to have developed between the Japanese Amateur Radio League and the folks at AMSAT. In case you missed that column, here's a brief synopsis.

When the JAS-1 Japanese amateur satellite was launched last August, the JARL renamed the bird Fuji after it was known to be in orbit and operating properly. However, at that time the AMSAT folks decided to call the bird OSCAR 12 and then Japan-OSCAR 12. Within a day, the JARL countered by sending out releases to most amateur publications saying that it was their satellite, and it was to be known as Fuji. And so it was that most of the ham press around the world began to do as the Japanese requested. Even AMSAT appeared to concede by changing their designation to Fuji-OSCAR 12.

Frankly, I thought that it would all end there, but it has not. A few days ago, ham publications received another telex from Japan, which was quite simple and to the point: "Please address the satellite only as Fuji." From this, I can only assume that the Japanese will insist forever and all time that the satellite be known as Fuji. Well, why not? After all, Fuji is their bird and they have the right to name it as they please. But, I did expect a compromise of some sort by now. AMSAT at least should be given an "E" for the effort.

Next month get ready for EATWG, and that's all for now from those of us who write the late shift from Los Angeles.■

FUN!

Number 16 on your Feedback card

John Edwards KI2U
PO Box 73
Middle Village NY 11379

HAM CLUBS

As far as ham clubs go, I've never been a joiner. Now don't get me wrong. For almost everybody, ham clubs are great. If run properly, they can entice kiddos into the hobby, provide a pleasant alternative to those stupefying TV football games, and possibly even promote the cause of world peace. But KI2U and ham clubs just don't mix, so don't even invite me to join one.

I'm not sure what the problem is. It doesn't have anything to do with the fact that I hold an Extra-class ticket. I also didn't fit in well with clubs when I held just a Tech, or even when I was unlicensed, for that matter. No, I guess I'm just not a coffee and doughnuts sort of guy.

This first became apparent to me one day back in the 70s when I attended a ham club meeting in my home town of New York City. This particular club (let's call it "The Tower of Apathy Radio Society") met at the old World's Fair site in a building that looked like a combination Minuteman silo/Egyptian tomb. The club officers and members were similarly schizophrenic.

I attended this particular meeting because advance word had it that the ARRL president was going to address his loyal minions. This was back in the days when I believed in Jimmy Carter, Z-80 computers, and the American Radio Relay League.

Anyway, on this fateful night, TARS self-destructed before its members' eyes. Boom! Pssfffft! Sort of like the way 160-meters acts when your neighbor puts a quarter into his vibrating bed.

TARS's undoing was the fault of one member (not me) who insisted that the club secretary read aloud the previous meeting's minutes. More clubs have destructed over this seemingly innocent request than all of history's botched Field Days and club picnics put together.

The reading of the minutes worked like a catalyst. Quickly, all of the club's rivalries, hatreds, antagonisms, spite feuds, and petty quarrels spilled out onto the club floor and poured over the feet of Roland P. Fahrquar, the ARRL president. By the time ol' Rollie got to speak, it was 11:45 p.m. and most of the TARS members were already home in bed or nervously looking at their watches. I hadn't seen so many people stare at Mickey Mouse since the last time I visited Disneyland.

A friend told me not to worry, that the club usually behaved in this manner. I didn't believe him. I knew my presence was at fault. I have that sort of an effect on clubs.

A few years later, in an unrelated incident, I played a role in the formation of a new ham club. This insane idea was the brainchild of me, AF2M, KB2UF, AG2U, and a few other guys who used to waste perfectly good evenings rag-chewing on 15 meters.

Collectively, we decided that our organization would be the singularly most obnoxious club ever formed. We would hold no formal meetings, perform no public service chores, and never enter a Field Day competition. It would be lots of fun, however, and one thing we really did want to do was to publish a newsletter. Ham radio as it oughta be, one might say.

We called our club "The Uncle Floyd Radio Club," after a local kiddie show host, and set about getting ARRL affiliation and putting together *QRM*, our club's soon-to-be official newsletter. After all, what good is a ham club without ARRL affiliation and a newsletter? Why, not to have these two standard features would be like driving a car that lacked power seats or cruise control. Heaven forbid.

How shall I describe *QRM*? "Raunchy," "irreverent," and "bad taste" are terms that immediately come to mind. I honestly wish I could tell you what we put between the covers of that publication, but a sober mind and Wayne's desire not to have *73* soil the breakfast linen prevent me from doing so. Let me just say that it had a lot of satirical bite to it. It also wasn't too kind to the powers that rule amateur radio.

Before the ink was even dry on the first 100 copies, we set about deciding who would get complimentary subscriptions to our journal. Eventually, thanks to the *Call-book*, we sent a copy of *QRM* to every prominent ham we could think of, from Barry Goldwater to Donny Osmond to Roy Neal to Archie and Veronica. If we had known that Bernie Goetz and Pat Sherrill were hams, we would have sent them copies, too. We did, nevertheless, send copies to the president and general manager of the ARRL.

"The reaction of the ARRL to its newest affiliated club's newsletter was swift and not altogether pleasant."

The reaction of the ARRL to its newest affiliated club's newsletter was swift and not altogether pleasant. Take it from me, the League is not always happy to see club newsletters, despite what they write in *QST*. Indeed, someone up at the League finked on us to our local division director, who was not entirely pleased to have the UFRC under his jurisdiction.

One night, the phone rang.

"Hello," I innocently said.

"Is this Edwards? President of something called 'The Uncle Floyd Radio Club'?" screamed the voice on the other end.

"Why, yes indeed," I replied.

"Well, I'm your ARRL division director," said the voice. "I just want to say that this *QRM* thing you're sending out is the single most disgusting piece of filth I've ever put my eyes on. You kids

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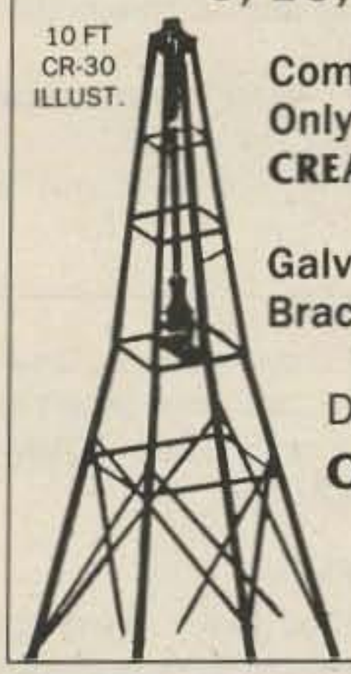

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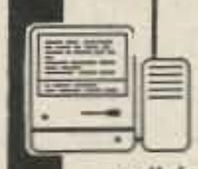

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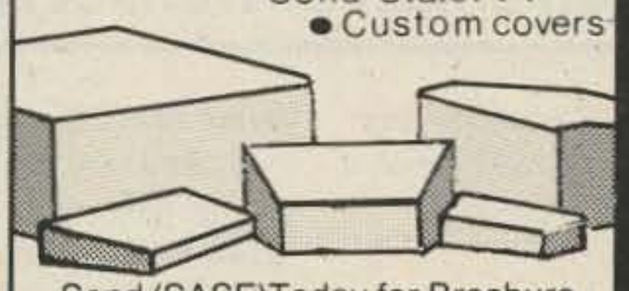

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ought to be ashamed of yourselves." (I was 22 at the time and recently graduated from college. But then, to the ARRL, I guess anyone not collecting social security is still a "kid.")

"Golly, sir. I guess we're just not working on the same wavelength," I said.

"Wavelength!" shouted the director, who was now on the verge of losing his voice. "I don't think you quite understand what I'm talking about. As an affiliated club, you're ARRL representatives. We can't have our clubs sending out pieces of stuff like this! (He didn't really say "stuff," but a euphemism for animal excrement.) Are you guys nuts?" (A point I had never considered.)

With that, the director told us we were an ex-ARRL-affiliated club. Sigh.

AF2M told me a few days later that he also received a call from the director. According to Bob, who was *QRM*'s editor, the tone of the conversation was pretty much the same as the one I had experienced. Unfortunately, Bob, during the course of the chat, managed to describe a trip the director took at League expense to Switzerland as a "paid vacation." This was an unfortunate choice of words that resulted in a string of obscenities pouring from Bob's phone, the like of which had never even made their way into *QRM*.

So, as I reflect on this little story, I realize I may be the only ham club president in amateur radio history ever to have had his club officially booted out of the ARRL. What a dubious honor: to be metaphorically thrown out of the gates of 225 Main Street and made to eat the bitter dust of Newington, Connecticut.

Don't believe me? Then check the *Callbook* for WA2DCS.

You know, I'm just not a joiner.■

RTTY LOOP

Number 26 on your Feedback card

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Okay, everybody—HAPPY NEW YEAR! "What's that? He said, 'Happy New Year'?" "He must be daft—he started off last month's column that way." "Doesn't he know that this is February?"

Well, yes, I do know that this is February, but the wish remains. Why? Well, let that be my challenge for the month. But I will tell you this—the wish is sincere and appropriate. And, a roll of Teletype® paper tape to the first of you who tells me *why* the greetings are in order. Want a hint? Consider the prize.

Software Solution

Now, on to the matters at hand. Last month I presented one man's solution to the "carriage return delay" problem with a Teletype teleprinter connected to a computer. His was a hardware solution. I promised you an answer in software. Fig. 1 is a flowchart of the proposed solution.

Following along, you will notice that a diversion is placed in the character output routine, via a convenient RAM hook provided by the author of CoCo Basic. Once you are sure that the device selected is the printer (DEVNUM = −2 or $FE), you see if the character being sent is a carriage return. If it is, a flag is set to remember this fact. If not, and the flag is not already set, the character is sent out the normal way. If the flag is set, however, the program loops to waste some time, while the carriage returns. By the way, if you wanted to, you could insert a few lines of code here to send out a line-feed character, for those printers that require a separate line feed.

Program listing 1 is an assembly-language listing of the program alluded to in the flowchart. It is written in position-independent code so users of 16K, 32K, and 64K CoCos should have no problems installing it. For all I know, it might even run on a CoCo 3.

COMMPRO

A few months ago, I noted a software glut for the Z-80 TRS-80 computers. As if by magic (fat chance), guess what I received in the mail? Lew McIntyre KB6IC of Omaha, Nebraska, tells me of his program, "COMMPRO," for the TRS-80 Model 4/4P/4D computers.

Lew's program...wait, let me tell you what Lew says about COMMPRO: "WAIT! Here is the program you have been waiting for! Written in Alcor Pascal specifically for the Model 4, the program is fast and powerful. It provides you with keyboard procedures that are customized for real-time data communications."

Some of the features this program includes are a split-screen display (featuring sixteen 80-character lines for receive and five 80-character lines for transmit) and two status lines (one dedicated for a Kantronics UTU and one maintaining system status information). Ten buffers are recallable with one key each; each buffer can hold up to 255 characters and can be loaded from or saved to disk.

Incoming traffic can be saved directly to disk, and file transmissions can be interrupted so that you can put in an identifier or ask for a quick confirmation of receipt—or just say, "Hi."

Do I have to include the obvious? Sure, COMMPRO operates on Murray (Baudot), ASCII, CW, even AMTOR, and has enough bells and whistles for a one-horse sleigh. (Remember that I write this a few months before you read it!)

Anyway, the whole thing costs but $30, and I'm sure Lew would be glad to answer any more questions you might have. Drop him a line at 3711 Gayle Avenue, Omaha NE 68123, and don't forget to tell him you read about COMMPRO in RTTY Loop.

"Kantronics' UTU will allow about any computer capable of driving a modem to interface with an amateur transceiver."

Kantronics UTU

I mentioned the Kantronics UTU above, and did not say much more about it than the name. Well, a letter from Travis Brann, the Technical Services Manager at Kantronics, arrived the other day with some information that may be of more than a little interest to many of you. One of the common questions lately has been of the "How do I get my _____ computer onto RTTY?" variety. Travis points out that their—and I might presume others'—line of "smart" terminals will allow about any computer capable of driving a modem to interface with an amateur transceiver.

Looking at Kantronics' Universal Terminal Unit, also known as the UTU, one can get an appreciation for just what a "smart" terminal is. The classic terminal unit acts as a translator between the

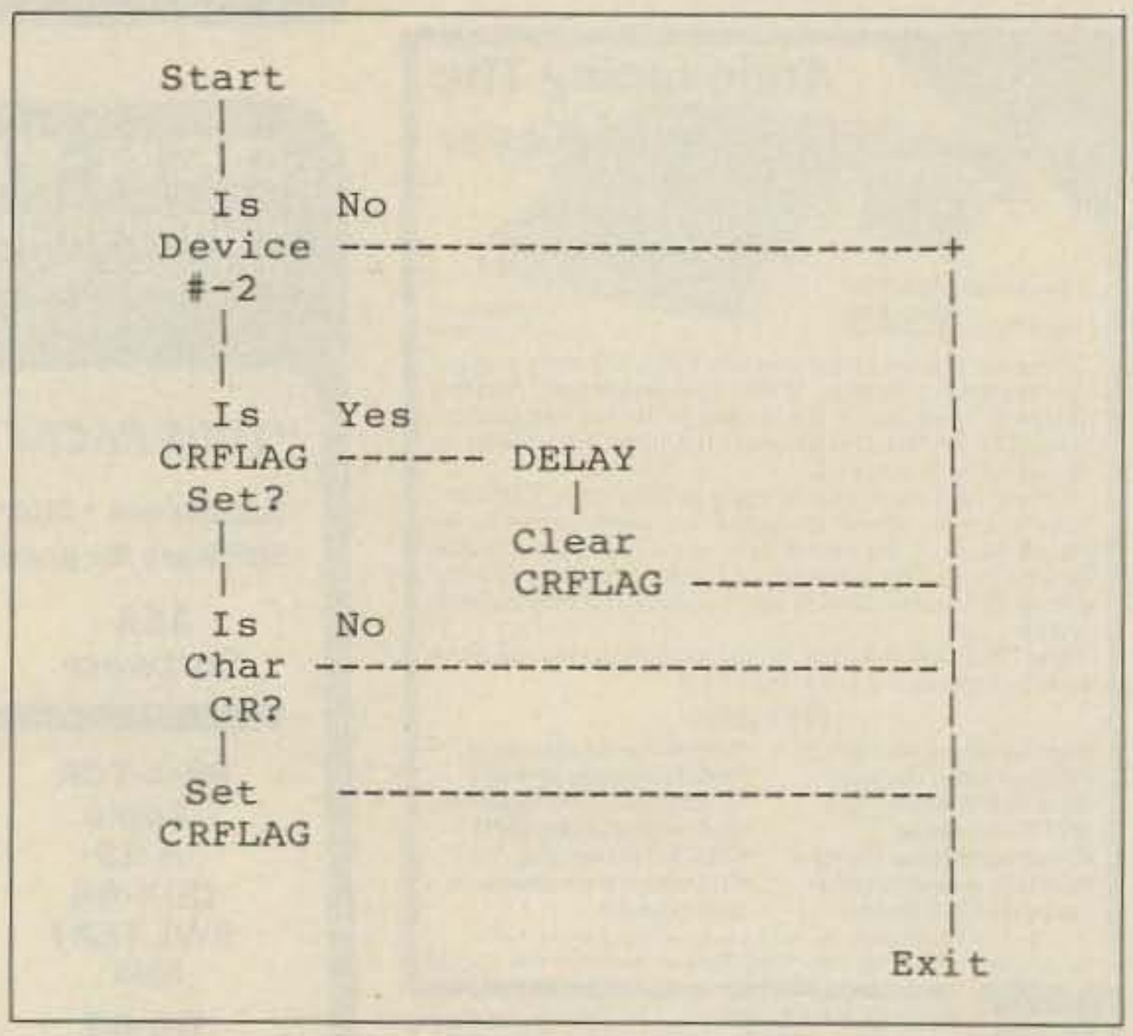

Fig. 1. Program flowchart.

```
                        00100 * PROGRAM TO ADD A DELAY AFTER
                        00110 * CARRIAGE RETURNS TO ALLOW A
                        00120 * MECHANICAL TYPE BASKET TO
                        00130 * RETURN
                        00140 ******** RTTY LOOP  FEB 1987 ********
                        00150 ** (C) 1986   MARC I. LEAVEY, M.D. **
      0167              00160 HOOK     EQU  $167
                        00170 *
0000 BE 0168            00180 START    LDX  HOOK+1
0003 AF 8D  0035        00190          STX  EXIT+1,PCR
0007 B6 0167            00200          LDA  HOOK
000A A7 8D  002D        00210          STA  EXIT,PCR
000E 30 8D  000B        00220          LEAX OUTDLY,PCR
0012 BF 0168            00230          STX  HOOK+1
0015 86 7E              00240          LDA  #$7E
0017 A7 8D  014C        00250          STA  HOOK,PCR
001B 39                 00260          RTS
                        00270 *
001C 00                 00280 CRFLAG   FCB  0
001D 81 FE              00290 OUTDLY   CMPA #$FE
001F 26 1A              00300          BNE  EXIT
0021 0D 1C              00310          TST  CRFLAG
0023 26 08              00320          BNE  DELAY
0025 81 0D              00330          CMPA #$0D
0027 26 120 '           00340          BNE  EXIT
0029 0C 1C              00350 SETDLY   INC  CRFLAG
002B 20 0E              00360          BRA  EXIT
002D 34 10              00370 DELAY    PSHS X
002F 8E FFFF            00380          LDX  #$FFFF
                        00390 * ADJUST THIS CONSTANT AS NEEDED
0032 30 1F              00400 DLOOP    LEAX -1,X
0034 8C 0000            00410          CMPX #$0
0037 26 F9              00420          BNE  DLOOP
0039 35 10              00430          PULS X
                        00440 *
003B 00                 00450 EXIT     FCB  0
003C 0000               00460          FDB  0
                        00470 *
     0000               00480          END  START
```

Program listing 1. Adds a delay after a carriage return to allow a mechanical-type basket to return.

signal, normally audio from a receiver or to a transmitter, and a local loop, either a current loop for a conventional teleprinter or RS-232 levels for a computer functioning in a terminal mode. That's it, maybe some kind of selective calling, but there are no other "smarts" on board.

These new smart terminal units change all that. The UTU, for example, has its own internal microcomputer, which allows any personal computer running a terminal program to interface on either RS-232 or TTL levels, and function as a full-featured RTTY machine. Accessing the UTU is through an internally generated menu, and simple keyboard commands control all operations.

The unit supports transmission and reception of CW from six to 99 words per minute; Murray RTTY on 60, 67, 75, 100, and 132 words per minute; ASCII at 110, 150, 200, and 300 baud; and AMTOR modes A, B, and L. All RTTY shifts are received, although transmission is only supported at 170-Hz shift. While an internal LED bargraph tuning indicator is available, conventional oscilloscope outputs are provided for those who like to watch flickering green ovals.

Check out some of the Kantronics line at your local dealer, or drop them a note directly at 1202 East 23rd Street, Lawrence KS 66046, and mention my name, OK? By the way, next month I'll tell you how to hook up a UTU or other "smarty" to quite a variety of personal computers.

One ham who has done just that is Robert L. Bobst K0SGE of Earlham, Iowa. Robert says that he is a newcomer to computers and RTTY, and has enjoyed much of what has been covered in this column. Anyway, he is using a Kantronics UTU, driven by a Tandy Color Computer using their Videotex terminal package. His ham setup is a Kenwood TS-180 with CW filters.

He finds that the UTU tunes very well with its visual LED bargraph display and, with the FSK filters in the Kenwood, it is extremely sharp. The drawback is that the FSK filters are on the wrong sideband on forty and eighty meters.

Also, he says the setup is "like a straight key, it keeps you honest." Robert says that with no hard copy facility and no way to review the text before it is sent, communications are more "live," and typing mistakes and small hesitations impart a lot of information about yourself and your contact.

I might note that this is more a function of the terminal program you are running than the UTU. Even a public domain terminal program for the CoCo such as MickeyTerm (available on both Delphi and CompuServe in the CoCo SIGs), which supports keystroke buffers, may help in facilitating some of your "live" problems. Good luck, and thanks for writing.

Sundry Items

Welcome to new subscriber Bill Porter KD9MR of Zion, Illinois. Hope you enjoy the wide variety of material here in *73*, Bill, and take the time to fill in that "bingo card." Use it to get valuable information from our advertisers, and to give valuable information to us, about what you like within these pages.

I don't know how "fabled" it is, Jim Zimmerman KG6VI of Lancaster, California, but I am happy to send you the list of reprints of old RTTY Loops. There is material in there for novices and old hands alike. Happy to mail a list to any of you; just send a self-addressed, stamped envelope to me at the above address, and be a bit patient. I do drag my feet a tad now and then.

Speaking of "fabled" items, greetings to Steve Rosman KA2YRA of Fresh Meadows, New York. Steve is using an OSI—that's Ohio Scientific for you newcomers—computer. On RTTY, Steve? As I recall, OSI used to use several CPUs in their computers. Wonder which one you have.

Cordial Hi-Ho-RTTY-o greetings to some more of our friends: C. D. Campbell, Jr. AA4UM of Madison Heights, Virginia; Jim New WA4DHD of Griffin, Georgia; Wayne King N2WK of Rochester, New York; and all the others who have dropped along this line or that over the last few months.

The information flow into this station continues at a record pace. Feel free, no—do more than that—I encourage you to drop me your questions and comments on RTTY, digital communications, and computers. Send written comments to me at the address at the head of this column, or electronic ones to me via CompuServe (ppn 75036,2501) or Delphi mail (username MARWA3AJR). I try to answer all questions received, either personally or in the column. I don't promise speedy responses, but I do respond.

I was not kidding about the little contest up front. The first correct response received, as determined by postmark on Postal Service letters or electronic dating on E-mail, to the "Happy New Year" question will win the responder a genuine roll of RTTY punch paper tape—unpunched, of course. Now, this should be interesting.

I've promised you a few things for next month. I'll keep those promises and add even more in next month's RTTY Loop.■

HAMSATS

Number 17 on your Feedback card

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

AMSAT GENERAL MEETING/ SPACE SYMPOSIUM 1986

Take a cool November weekend in Dallas, add about 150 dedicated satellite enthusiasts, mix in some of the world's foremost ham satellite designers and supporters, and you end up with the 1986 AMSAT NA (Radio Amateur Satellite Corporation of North America) General Meeting and Fourth Annual Space Symposium. This annual meeting gives us a status report on AMSAT and helps shape our direction for the future.

Presently, our most exciting satellite activity centers on the experiments with the digital transponder (mode JD) on board Fuji-OSCAR 12. At the Space Symposium, JAMSAT (the Japanese affiliate of AMSAT NA) president Harry Yoneda JA1ANG discussed the challenges faced by those responsible for the success of FO-12.

Former AMSAT NA president Dr. Tom Clark W3IWI (Photo B) demonstrated a prototype modem to allow a standard packet TNC access to the Manchester-encoded PSK used for mode JD on the satellite. The version Tom demonstrated included circuitry from the JARL/JAMSAT PSK demodulator described in the August, 1986, issue of *QEX* and modulators he developed in conjunction with TAPR (Photo C). A full kit or semi-kit of parts should be available from TAPR soon if interest is sufficient.

A British version by James Miller G3RUH has been available for several months. Although the circuit is somewhat simpler than the JAMSAT/TAPR version, it has been tested and is rather easy to build. It is presently in stock at Radiokit, Box 973, Pelham NH 03076; (603)-635-2235. The complete kit is available for $99 (not including cabinet; requires power supply). Just the PC board and instructions cost $24.99. A cabinet is available for $12. (There is a flat $4 shipping and handling charge—non-U.S. orders please inquire.)

I have found the G3RUH version to be quite functional. Note the FO-12 PSK telemetry in Fig. 1. This is just a small portion of the tens of thousands of bytes of data received with the G3RUH board on a single mode-JD pass. The PSK signals from FO-12 are quite strong on a beam antenna with a simple preamplifier.

```
8J1JAS>BEACON:JAS-1 RA 86/11/16 02:27:50
002 676 647 647 701 877 888 862 003 273
648 002 548 591 582 576 578 580 689 002
721 715 723 717 767 678 927 000 000 000
010 111 100 000 100 000 001 000 000 000

8J1JAS>BEACON:JAS-1 M0 86/11/16 02:27:52
Telemetry Information:
#00(1st):solar cell current = 1.91*(N-4)   mA
#01(2nd):battery current    = 3.81*(N-528)mA
#02(3rd):battery voltage    = N/1000*21.0  v

8J1JAS>BEACON:JAS-1 M1 86/11/16 02:27:53
86/11/15 17:10:00 JTD ON
yy/mm/dd hh:mm:ss JTD OFF
yy/mm/dd hh:mm:ss JTD ON
yy/mm/dd hh:mm:ss JTD OFF
yy/mm/dd hh:mm:ss JTD ON
yy/mm/dd hh:mm:ss JTD OFF
yy/mm/dd hh:mm:ss JTD ON
yy/mm/dd hh:mm:ss JTD OFF
```

Fig. 1. Fuji-OSCAR 12 telemetry and information received from the digital beacon. AX.25 protocol with PSK modulation.

Any differences in performance between the TAPR and G3RUH units will likely be overshadowed by the signal levels present. When the "mailbox" software is loaded into the FO-12 computer, activity will be much more exciting than just copying telemetry.

Interfacing an FO-12 modem to a typical amateur radio satellite station is not easy. Note all of the interconnections shown in Fig. 2. In addition to microphone, PTT, and speaker connections, digital control of the receiver is necessary to counter Doppler shift during the satellite pass. Wiring modifications are necessary inside your TNC. The end result is quite satisfying, but it is a lot of trouble to make the custom inclusion of the new modem.

PSK has a 10–20-dB advantage over the typical Bell 202 AFSK FM in common use on VHF today. Although PSK is our only way to receive the digital signals from FO-12, we may also see this form of signal modulation become quite common for terrestrial use as the advantages become more apparent.

OSCAR 10

Fuji-OSCAR 12 isn't the only hamsat in the sky. Even with its declining memory, AMSAT-OSCAR 10 has been released for "guarded" use whenever the transponder is turned on. Since there is virtually no control over spacecraft attitude (its orientation in space), signal levels and operating schedules are impossible to guess. AMSAT vice president for operations Ralph Wallio W0RPK (Photo D) presented a failure analysis of AO-10 at the Space Symposium. The most significant fault noted was the radiation damage sustained by the Integrated Housekeeping Unit (IHU) memory.

Photo A. Dr. Tony England W0ORE talks about future ham-in-space activities at the AMSAT Space Symposium.

Photo B. Former AMSAT president Dr. Tom Clark W3IWI explains phase-shift keying with the Fuji-OSCAR 12 digital mode.

Photo C. The JAMSAT/TAPR FO-12 modem on top of a TAPR TNC.

Photo D. AMSAT vice-president for operations Ralph Wallio W0RPK presents the OSCAR 10 status and engineering report.

Dr. Martin Sweeting G3YJO of the University of Surrey discussed the continued operation of the UoSAT series of amateur spacecraft. UoSAT-OSCAR 9 and UoSAT-OSCAR 11 continue to send telemetry in many modes including voice, CW, and ASCII to monitoring stations the world over. Predictions on the life-expectancy of the remaining RS satellites were impossible, but new replacements may be just over the horizon.

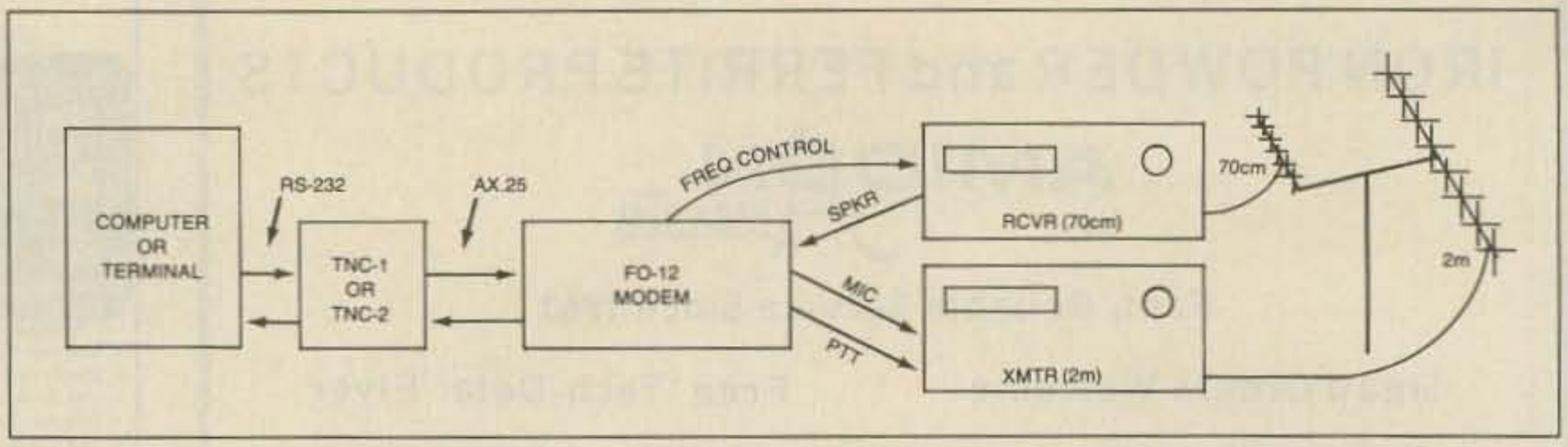

Fig. 2. Block diagram of the equipment needed for FO-12 digital mode.

The Future

Looking to the future was an AMSAT activity shared by all participants at the Dallas meeting. What frequencies will the new RS birds use? What experiments will be on board the next UoSAT? What's the status of the French Arsenne project? What can we expect from the digital experiment on Phase 3C, OSCAR 10's replacement? What will the new modes be like? Two very far-reaching projects on the active list for the future include the Packet Technology Satellite Experiment and studies on the possibilities for Phase 4 (geosynchronous amateur radio satellites).

The PTSE project is based in the Houston area and may include a series of small low-earth-orbit (LEO) satellites demonstrating packet "digis" with "mailboxes" in space. The space hardware will allow uncomplicated ground stations using a standard TNC and FM two-meter rig with a simple "omni" antenna and moderate power. The user will be able to "connect," and then retrieve and leave messages on the system. Since the first stage of the project depends on the use of the space shuttle, it will be a long-term undertaking.

Projecting even further is the Phase 4 project. The attendees at the Space Symposium showed their intense interest for geosynchronous hamsats by packing the meeting room for AMSAT vice president for engineering Jan King W3GEY's technical review of the topic. This was at 7:30 a.m. on Sunday. In addition to all of the fantastic possibilities of a satellite suspended over one area of the earth, Jan pointed out the enormous cost in time and money needed to pursue the project.

Some of the goals of Phase 4 include spectrum occupancy of the VHF, UHF, and microwave bands and public benefit with education, emergency preparedness, and international exchange. Involvement from other amateur-radio and space-community groups will be necessary due to the large scope of the project. Phase 4 will not include simple satellites. They will be very sophisticated, technology-bending experiments in space using many untried concepts for efficient and powerful amateur communications. AMSAT NA has approved funding for the feasibility studies.

Satellite Tracking

Enough of these crystal-ball sessions. There are other projects closer to the present, but before you can pursue ANY satellite effectively, you will need to know where the spacecraft are and where to listen. You need tracking information.

Tracking can be a simple task with the help of a number of aids ranging from inexpensive mechanical plotting devices to completely automated, computer-driven rotator systems. Each method differs in cost, function, and complexity. The correct one for you will depend as much on your preferences and needs as on the status of your checking account.

Manual Tracking

For many years, manual tracking aids have been the primary tools used by satellite chasers to keep tabs on OSCAR and RS satellites. Those aids usually consist of a polar projection map and some clear overlays imprinted with signal-acquisition circles and satellite ground tracks.

An acquisition circle shows the maximum range of the satellite and thus its accessibility to a ground station. The ground track shows the path of the satellite projected over the earth's surface. Together, they provide a graphic means of finding usable passes and give information for accurately orienting antennas toward the passing satellite.

With the help of an orbital calendar (such as those available from Project OSCAR, PO Box 1136, Los Altos CA 94022) the times and longitudes of ascending equatorial crossings can be determined. Used in conjunction with the manual tracking aid, the information quickly gives you passes that will be in range of your station and the times that a satellite will be above your horizon.

Manual tracking works quite well for low-orbiting satellites, such as FO-12, and permits you to visualize the path of the satellite as it travels around the earth. With some modifications, those aids can be adapted for use with OSCAR 10 and other satellites with high elliptical orbits, but the chore can be difficult. Because the orbital altitude is no longer constant, and due to other orbital characteristics, the ground track is continually changing. Thus, a new overlay is required every six weeks or so.

Manual tracking aids can be built or purchased. The ARRL sells its OSCARLOCATOR package, and ZRO Technical Devices (PO Box 11, Endicott NY 13760) markets a device called the Satellipse. Instructions on how to put together and use a manual tracking system can be found in *The Satellite Experimenter's Handbook* by Martin R. Davidoff K2UBC (available for $10 from AMSAT, PO Box 27, Washington DC 20044).

The cost of a manual tracking aid is minimal and preparing it for a pass requires little time. However, some effort is required to keep up with the latest equator-crossing information.

Computer Tracking

The home computer has become an increasingly popular tool for keeping track of amateur satellites. With a good tracking program and printer, one can make accurate orbital predictions and generate a detailed plot for weeks or even months into the future.

Excellent programs are available for the C-64, IBM PC and clones, and many others. Program complexity varies from one machine to another. Some programs provide only a tabular listing of times and antenna pointing angles, while others can keep up with many satellites, constantly updating their positions on a map of the earth. There are several sources of tracking software. A good place to start is the AMSAT Software Exchange at the address noted above.

The ultimate tracking system is one that will automatically find a chosen satellite and then aim the antennas for you. Such a system uses special interface circuitry to tie the computer to the antenna rotator. Of course, specialized software is also needed to determine antenna orientation and to keep the antenna aimed at the predicted satellite position. If you'd like to go the home-brew route, there was an article in *Orbit* Magazine, issue 11, for the Apple computer. The September, 1986, issue of *QST* has an article about an RS-232 connected antenna positioner.

Spectrum West of Seattle, Washington, markets an interface for the VIC-20, Timex 1000, and C-64 in conjunction with potentiometer rotators such as the Kenpro KR400/500 series. Encomm of Dallas, Texas, recently released an interface cartridge that plugs into the game port of the C-64 or C-128. It is designed for the Kenpro 5400A or 5600A rotators and works with the C-64 Maptrak program sold by AMSAT. This unit will not work with the older control boxes for the 5400 and 5600. The older units do not have thermal cut-offs which are required for use with the interface. Encomm promises an IBM version soon that will use the serial port. It will also work with the PCjr.

If you already own a computer or have access to one, your best bet is to get a satellite tracking program. If computers are not for you, a manual tracking device will keep you pointed in the right direction. Remember that satellite tracking is not difficult to learn. It will help you make contacts via the highest repeaters around.■

WEATHERSAT

Number 28 on your Feedback card

Dr. Ralph E. Taggart WB8DQT
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SATELLITE DISPLAY SYSTEMS

Feedback! Although this is already the fifth column to appear in print, only a single one has actually hit the stands as I sit down to write this one! Already, however, I am beginning to get some initial feedback, much of which I hope to incorporate as we go along.

One persistent theme in the early letters concerns the business of actually displaying the satellite images—usually expressed as a request for recommendations as to the "best" display system for the satellite station. There are many approaches to satellite image display, and none of them is "best" from all points of view.

Since this is bound to be a recurring theme, I will devote this column to a basic description of the various approaches. Detailed descriptions of projects of each type can be found in the *Weather Satellite Handbook* and other sources. This time around, I will confine the discussion to the basic approaches, along with the advantages and disadvantages as they occur to me.

As far as the approaches are concerned, there are three primary ones, some with functional subdivisions. They include analog CRT displays, facsimile recorders, and digital scan converters. These three quite different approaches to image display need not be considered as completely separate, however. With careful choice in the selection of circuits used, many components from one project can be used in another.

This "modular" approach to design forms the basis for the projects described in the latest edition of the *WSH*, facilitating the growth in sophistication of your station with time. In fact, it is entirely possible to have one central console that will drive all three forms of display with no duplication of common circuit modules if you want to go that route.

Analog CRT Monitors

CRT monitor circuits are very appealing to new satellite experimenters because they are both simple and versatile, providing many a newcomer to the hobby with his or her first views of the Earth from space.

A basic analog CRT monitor has very few circuit elements. You need video circuits to convert subcarrier amplitude to brightness variations in the CRT trace, a timebase to provide either 4-Hz or 2-Hz trigger pulses for the horizontal line sweep, some horizontal deflection circuits to scan the raster from one side of the screen to another during the interval between trigger pulses, and a vertical deflection circuit to scan the raster from top to bottom in either 400 seconds (WEFAX, 240-line METEOR, and visible or IR NOAA APT) or 800 seconds (simultaneous visible and IR NOAA APT or 120-line METEOR).

Phasing circuits and control of vertical sweep are usually manual, resulting in an extremely simple design. Since a single timebase can generate both 4- and 2-Hz signals quite easily and since multiple sweep rates are a simple matter of switches and adjustable pots, the CRT monitor is inherently a multimode device, easily constructed or modified for display of any direct-readout satellite format.

Essentially a CRT monitor "paints" the incoming satellite image on the screen in real time. Given the range of available phosphor types for the CRT, you cannot "see" the entire image at any time. This means that the CRT display must be recorded using a time-exposure photograph, usually taken in a darkened room or with a light-tight hood. Physically, the monitor approach can range from an external "black box" driving an oscilloscope or modified TV or computer monitor chassis for display, up through dedicated monitors with everything built into a single cabinet.

With a small CRT (five inches or less), it may not be possible to focus the scanning raster sharply enough to achieve the full 800-line resolution expected in, say, the WEFAX format, although the pictures from a small-screen display can be entirely satisfactory. Full resolution can usually be obtained with screen sizes of eight inches and larger.

Advantages include simplicity, low cost, and inherent multimode capability. Most of the disadvantages involve the need to photograph the image. Instant pictures will require the use of Polaroid™ film and cameras, and this can run into some expense if you take a lot of pictures, not to mention the fixed (and relatively small size) format of the resulting photograph.

The use of 35mm cameras and film reduces costs considerably and permits any desired final image size (with enlargements from the original negatives). This approach works well if you are already into photography, but some work and delay are always to be expected before you see your pictures.

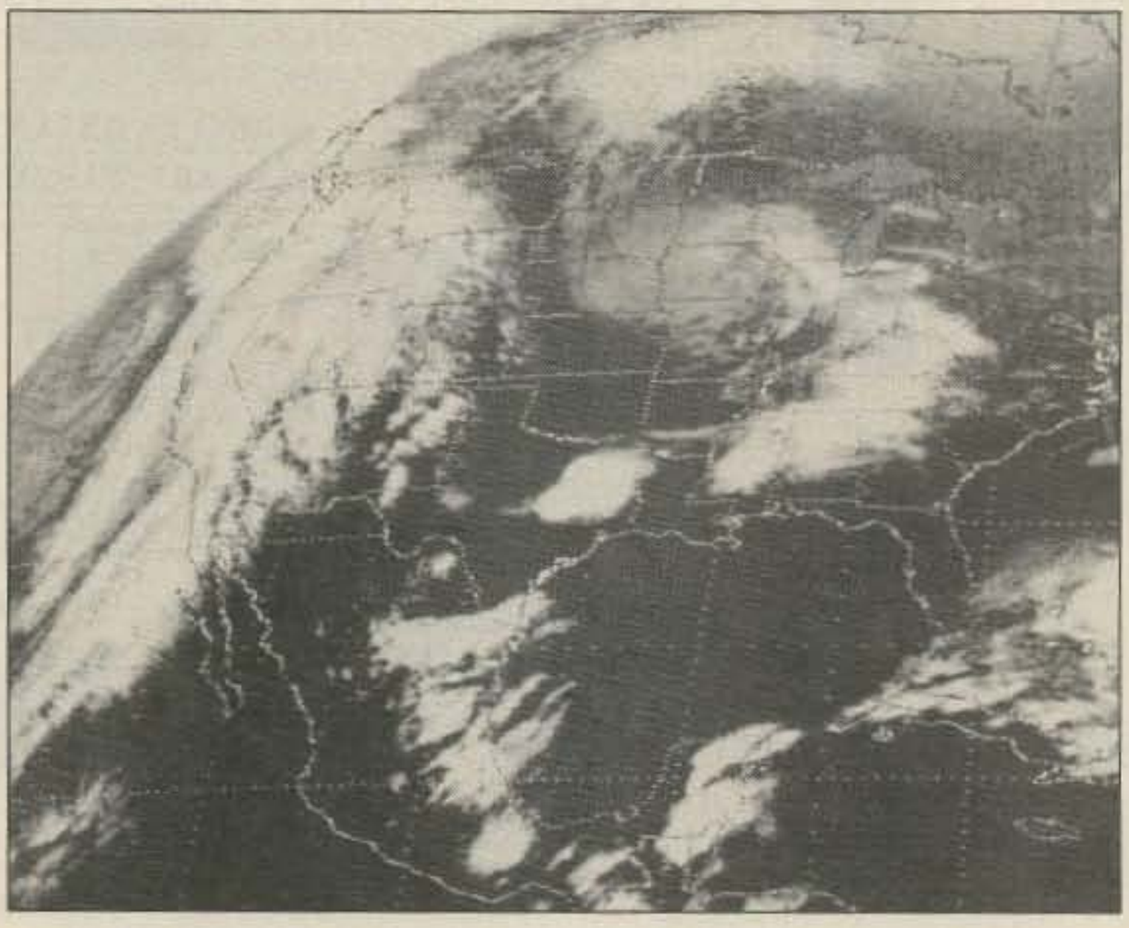

Photo A. A photographic FAX print of an old NW WEFAX IR quad, printed on a photographic version of the FAX recorder described in the Weather Satellite Handbook.

Facsimile Recorders

A FAX recorder is a combination of electronics and mechanics that, in one way or another, ends up printing an image directly onto a piece of recording paper. Recording media may be various types of photographic material, where the image is "painted" using a modulated light source, or the medium may be an electrostatic or electrolytic paper in which the image is created by applying a modulated voltage to the stylus, creating mechanical or chemical changes in the paper that produce the image. Photographic media always require some sort of processing to view the final image, while electrostatic or electrolytic media usually produce the image directly.

FAX recorders can also be classified in terms of how they handle the paper. In drum-type recorders, the medium is loaded a single sheet at a time, and each picture requires loading of a new piece of media material. Continuous-feed recorders feed the medium from a roll and can typically print a large number of pictures without reloading. Before looking in more detail at media and design, some general observations are in order.

All FAX recorders achieve the proper speed for the equivalent of horizontal and vertical scanning by using synchronous or stepper motors in conjunction with various kinds of mechanical drives. This means that any home-built FAX project involves both mechanics and electronics (for signal processing, timebases, and motor drives).

To print a decent FAX picture, all of the mechanical elements have to function with a high degree of precision; this makes the construction of a FAX recorder a more demanding exercise for most people than a comparable CRT display. In all fairness, it can also be fun, if occasionally frustrating, if you like to fiddle with "gadgets."

Media

The common photographic media fall into three categories—printing on photographic film, direct printing on standard photographic enlarging paper, and direct printing on heat-processed photographic paper. In the case of film, the system is designed to produce a photographic negative from which contact prints or enlargements can be made.

The primary advantage of film is

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that extremely sensitive film can be employed, permitting the use of a low-level light source, such as a modulated LED. The disadvantages of film include the high cost of cut-sheet film and its limited availability, and the inconvenience and time involved in wet-processing both film *and* prints.

Direct printing on standard enlarging paper is the most common approach to a photographic FAX system. The electronics must be designed to cause a positive image to be printed on the paper, and only the paper need be processed. Images can be of exceptionally high quality and, like all properly designed FAX systems, this one will always give you a full-resolution image. The paper is quite a bit less expensive than an equivalent size of cut-sheet film, and processing is less demanding. You do have to maintain a minimal darkroom, preferably with the recorder located inside it, but such a system can produce pictures of the highest possible quality to justify your added efforts.

Heat-processed photographic media are produced by companies such as 3M and are used in recorders like the Harris Laserfax™. They handle like conventional photographic paper up through the exposure, but differ in that the processing involves running the paper through a set of heated rollers to bring out the image.

The images can have all of the inherent quality of a standard photographic FAX system and yet avoid the disadvantages of "wet" darkroom processing. Despite this advantage, I do not like these papers—even after extensive experimentation.

First, the images will darken with extended exposure to normal room lighting. They will retain their original dynamic range only if stored out of the light. Second, once exposed to room light for however short a period, any further exposure of the paper to high temperatures will completely blacken the image. I discovered this one day with an astonished look at some prime prints that I left in a briefcase in a car on an August day!

All of the photographic paper systems share a common problem related to the fact that the papers are far less sensitive to light than film. This requires a fairly intense modulated light source for exposure, usually a glow-discharge crater tube of some type, operated from a high voltage supply (300–400 V), used in conjunction with a lens system.

Date	01 February 1987	
Spacecraft	NOAA-9	NOAA-10
Orbit Number	11011	1939
Eq. Crossing Time (UTC)	0001.33	0041.33
Longitude Asc. Node (Deg. W.)	135.63	77.46
Nodal Period (Min.)	102.0851	101.2979
Frequency (MHz)	137.62	137.50

These orbital parameters are projected two months in advance due to deadline considerations. Accumulated errors due to uncompensated orbital decay and other anomalies result in expectation of errors up to two minutes and possibly as many degrees in terms of the crossing data and possible small changes in the indicated period. Users requiring precision tracking data should rely on more current sources.

Table 1. TIROS/NOAA orbital predict data:

The crater tubes are becoming harder to obtain, and costs are definitely on the rise. Fiber-optics and solid-state lasers represent one possibility for the next generation of alternatives for modulated light sources.

Electrostatic and electrolytic media have the advantage of producing an immediate image without additional processing. Electrostatic papers work by applying a high voltage to the paper, burning away varying amounts of a white surface layer to expose an underlying black base layer.

Of the various electrical papers, electrostatic media have the potential to produce a fine grayscale (in true black and white) that can approach, although never truly equal, photographic paper in quality. The papers are dry and require no special handling or storage, the image can be printed in normal light, and the images are absolutely permanent short of conditions that would discolor any normal paper products. The principal disadvantage of such papers is that they produce a small amount of smoke during the printing process.

Electrolytic papers work by means of the applied stylus current, inducing a proportional chemical reaction in the paper that causes it to darken at the point of applied current. The quality of the resulting grayscale depends upon the specific type of paper, and most result in a sepia-and-white image instead of a strictly black-and-white rendition.

These papers must be moist in order to function, a factor in both storage and the design of the recorder so that the roll of paper (most are used in continuous-feed machines) stays moist until all the material has been used.

Image permanence varies greatly with paper type. The best papers will discolor only slightly with time, but many grades will darken or fade to the point where the images are eventually useless.

Electrolytic systems excel in the continuous-feed mode, where large numbers of images must be produced and analyzed but where archival qualities are not at a premium. If the number of pictures required is smaller, electrostatic recorders can provide a noticeable increment in quality and permanence with a high level of convenience. Photographic systems can provide the apex of quality, but are usually best suited to a low image volume given the additional processing requirements.

FAX recorders, whether home-constructed or modified from commercial surplus, offer full-resolution capability with image quality dependent on the specific medium.

The major operational disadvantages of FAX systems are twofold. First, the mechanical nature of the system confines you to a single size format and, since motors and gears control "scanning" rates, it is more difficult to achieve multimode capability with a FAX recorder than is the case with a CRT or scan converter system. Second, a FAX machine has to be fed paper, and the budget for paper and processing chemicals (if needed) can become burdensome if you want to handle large numbers of pictures, such as the daily image output of a spacecraft like GOES Central!

Digital Scan Conversion

Digital scan converters accomplish the seeming miracle of taking a slowly arriving satellite picture and converting it for display on a standard TV monitor. In principle, all such systems operate by converting the incoming video variations to numerical values that are stored in solid-state memory as they arrive. While the information must arrive slowly in the normal satellite video format, the output of the memory can be cycled at extremely fast speeds to create a non-fading image on a TV monitor, which will persist as long as power is applied to the system.

Scan converters have two primary configurations: hard-wired, in which all of the image sampling and output functions are wired into the unit, or the more desirable microprocessor-controlled mode, where image sampling and display are under software control. The latter includes scan converters controlled by a variety of small microcomputers. The *WSH* delves extensively into both the theory and construction of scan converters, and I will not repeat much of that basic information here.

Suffice it to say that there are two primary constraints on the quality (resolution and grayscale capability) of a scan converter. The first is the size of the memory available to store the image data. This was a serious constraint in the days when microcomputers were limited to 64K of available RAM. But with various approaches to extending memory capacity, together with a steady drop in the price of memory, it is now practical to store an entire image at essentially full-resolution with so many grayscale steps (255) that you cannot perceive the digital nature of the image.

The real bottleneck is the TV display. Depending on the set or monitor, spatial resolving capabilities (in convenient digital terms) will range from a low of 256 pixels/line with 256 lines in a non-interlaced display to a maximum of about 512 pixels/line with 512 lines for a top-line display with fully functional interlace. Sixteen grayscale steps/pixel usually provides acceptable tonal resolution, and if you go to 32 or 64 steps/pixel, the results are indistinguishable from analog on the best standard monitors. With appropriate sampling, either from the incoming picture or from

a larger image data set in memory, very fine full-frame images can be displayed even though they lack the full resolution of the image format.

When one considers that a scan converter can display all of the products of a given satellite automatically, without using a single sheet of paper, the appeal of these devices is understandable! The *WSH* describes an extremely simple display board with 32K of resident RAM that will display a 256 by 256 image with 16 grayscale shades, which can be used with virtually any computer, assuming software is available, to provide satellite image display.

How you get more resolution is a matter of the memory capacity of the host computer. In the case of my trusty Color Computer, which has little more available RAM than the display board itself, the solution is to sample smaller portions of the image at higher intensity. You may be limited in basic display capability, but there is nothing to stop you from displaying progressively smaller portions of the image at that same resolution, the result being that the patch you choose to look at can be displayed at the theoretical limits of resolution of the video format in question.

If you have more RAM available in the computer, the task is even easier, even if it requires some tricky memory management. In the case of an IBM PC or clone with 640K, for example, the entire image can be sampled and stored at essentially full resolution. Your basic display capability can then be used to view a sampled version of the whole frame or you can "zoom" in on the contents of memory for a more detailed look at any portion of the image.

A microprocessor-controlled scan converter can do many other things as well. It is possible to process the image for enhancement or any other purpose (the subject of a future column). You can generate false-color displays, images, or portions of images; you can save them to disk for later recall. The possibilities abound!

The only real drawback to a scan converter is obtaining a permanent copy of a picture of particular interest. Roll-film photography from a monitor is convenient since you already can see the image and hence the wait for the hard-copy version is rarely an issue.

Still another technique, largely unexploited, is to use a FAX machine to make your copy! Assuming the image is in memory, there is no reason why the computer, with the help of some external circuits, cannot output the image in a format the FAX machine can print without difficulty. Note that the computer controls the output function in this case, so there is no reason why the output format has to match the original image format! In effect, *any* FAX machine could print a satellite image as long as the computer could format the image for the machine in question.

A major advantage here, aside from being able to print out any satellite image on any FAX system, is that you need only print images of particular interest. With the FAX recorder alone, you must print the picture to see what it contains. If it is not particularly interesting, you have wasted the paper. With the scan converter, you get to watch *all* pictures, but need print only those you want.

If you want to build a FAX printer for your system, it will generally be less complex than a standalone recorder simply because the computer can handle many of the control functions that have to be hard-wired into a dedicated FAX recorder.

The future of scan converters is very bright, not only as the primary display system in a station but as a useful adjunct to other display systems. The flexibility of a computer-controlled display is also at the heart of any upgrade to a high-resolution VISSR display with GOES or HRPT display from the TIROS/NOAA spacecraft (see last month).

Picture of the Month

Since I have spent a fair amount of space talking about FAX, this month's picture is a photographic FAX print of an old NW WEFAX IR quad, printed on a photographic version of the FAX recorder described in the *WSH*.

Note

References to the *Weather Satellite Handbook* refer to the third edition, available directly from yours truly for $12.50 plus $1 shipping in the U.S. or $2 elsewhere.■

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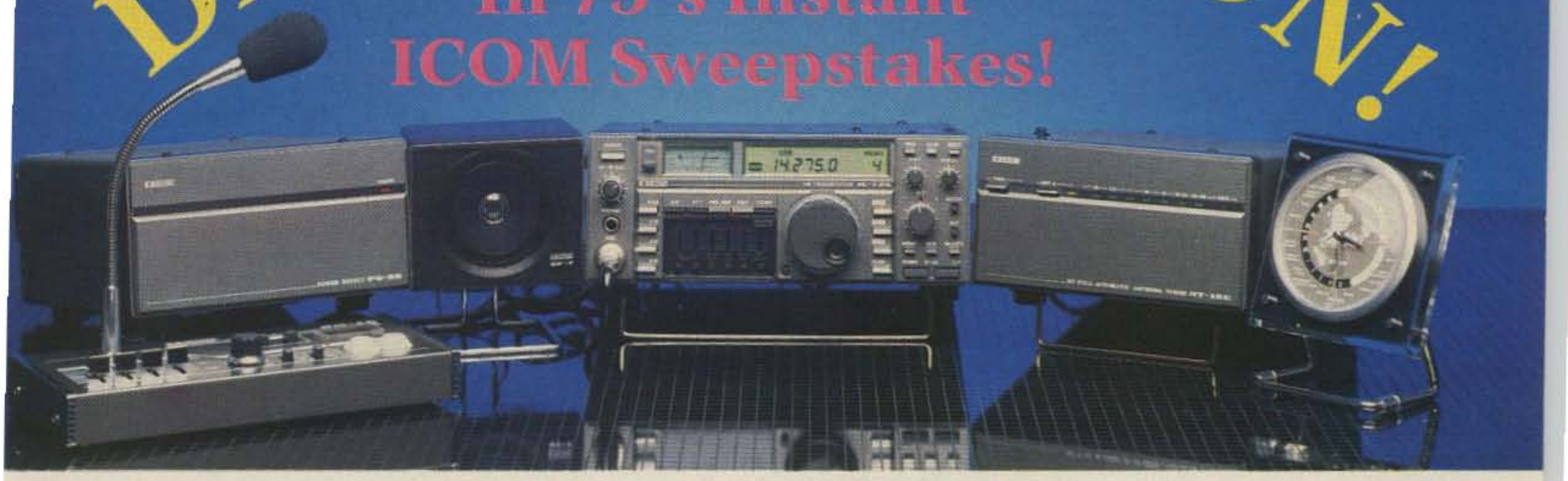

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Number 27 on your Feedback card

NOTES FROM FN42

Sri Lanka joins us this month—just in time for us to wish it a happy Independence Day (February 4). February 6 is Watangi Day (New Zealand Day), and the 11th is Founding of the Nation Day in Japan, where (according to The Economist *of London) the average income of the 121 million Japanese is now $17,000 per year. The magazine says that the average income of 242 million Americans is $16,000. All other aspects of this aside (as being irrelevant to this column), one reason for Japanese successes is that they learned a great deal from the United States—and we wish them a happy Founding Day. It now is appropriate to note that the time has come in the cycle of world affairs for the U.S. to learn from Japan. Which is a roundabout way to wonder out loud when JARL is going to name a foreign correspondent to this column—to help us start to learn how they do it. . . it is time, JARL, for you "to establish a horizontal relationship" with us. (To the Japanese businessman, that means dealing with the "horizontal" English language.) And the 11th of February also is the 139th birthday of Thomas Alva Edison, from whom everybody learned. Happy birthday, Mr. Edison, and many, many thanks.*

ROUNDUP

On November 3, 1986, the United States, at the stroke of a pen, became 17,000 people bigger. Huh, you ask? That was when, after more than 11 years of bureaucratic paper shuffling, the Northern Marianas (meaning all those islands except Guam) became a U.S. Commonwealth and the inhabitants became U.S. citizens. The KG6s, KG6Ts, KH0s, and KH2s on Tinian, Saipan, and Rota (to name the largest three islands affected) became U.S. hams. So send your congratulations; make Governor Pedro P. Tenorio an honorary ham. Make contact and collect a card dated during the first year of the new status.

A Directory of Awards and Diplomas. A booklet "listing full details of over 250 awards and diplomas" has been created by G1TZU, who sent us this information along with a couple of sample pages and the index. It is a fascinating list that appears to be organized alphabetically by country (with a slip here and there—in the index, anyway, where Austria is followed by Australia, Japan by Hungary, then Japan again—but these were probably draft pages that we got). The list starts with DX Widows Award (Australian?), goes through Worked All Malaysia, and ends with the San Cristobal Award (must be Venezuelan). The booklet is available for 3 pounds, U.S. $8, or 15 IRCs from Mrs. Sue Squibb G1TZU, 36 Frognal Gardens, Teynham, Sittingbourne, Kent ME9 9HU, England.

Sixteenth SARTG RTTY Contest Results. August's Scandinavian Amateur Radio Teletype Group 1986 World RTTY Contest results listed two U.S. stations in the top ten: WA7EGA in second place and WB5HBR in sixth place. Ten U.S. calls were among the 78 logs submitted. The top five in Class A (single-op), B (multi), and C (SWL) were:

A. G4SKA 219,600; I7FKO 218,435; HB9HK 211,560; SM5FUG 202,710; and EA5FKI.
B. LZ2KIM 316,220; WA7EGA 210,900; OH2AH 150,520; OH2OT 54,280; and YU2CRS 31,785.
C. OH–100 272,330; DE2QRV 214,360; ONL–383 98,100; Y2–2814/M51 77,140; and OH2–900 54,280.

Our Global Electronic Village. An electronic global community began to form when the first wireless transmission was completed across a national boundary. Radio amateurs were its first citizens and still are sinews and muscles for this new mega-village. What part will amateur radio enthusiasts play in the future as TV becomes one of the strong links between all peoples everywhere? Hams have a common language and a common (technological) culture; this will not be the case with TV viewers. It is time to think about this because *before you are 15 years older* TV's biggest market in the world will be China, although at present, in China and India, where nearly half of the Earth's population lives, the "TV culture" is just now beginning.

Carlo Sartori, writing in *Panorama* [of Milan, Italy—excerpted in *World Press Review*, December, 1986], reports on TV's rapid growth since its birth in England in 1936. The U.S. was first to have a TV culture, then it came in the early fifties to industrialized Europe and Japan, the Communist bloc countries in the late fifties, and Latin America and Africa in the sixties. Some dates of nations getting TV: South Africa in 1976, Sri Lanka in 1979, Burma and Swaziland in 1980, Mozambique in 1982, Nepal in 1984, and now, Papua New Guinea.

In the U.S. today there are 300 private (non-network) stations; in Europe, national borders have no meaning to TV as a result of Murdoch's satellite Sky Channel (reaching six million homes in 10 nations), and other such endeavors (the British Superchannel, Brazil's Globa network out of Monte Carlo, and Ted Turner's CNN plans for Europe). Even state-controlled TV is going to be a part of the TV picture, according to Sartori, who reports that, for example, as early as 1979 the Communist Party Central Committee in Moscow condemned government-controlled TV for its "formalism, verbosity, propagandistic cliches, gray commentary style, and mechanical repetition of official truths to the detriment of creative interpretation." [Wow!!]

Look at what you started, radio amateurs of the world! What are you doing now to help the world's *people* understand each other as you understand each other already?

A global village? You bet! Look at the report from Ralf Beyer DJ3NW below. All about the Federal Republic of Germany? Nope. All about the Italian beacon robot, IY4M. And Rune Wande SM0COP reports on the European License: more boundaries vanish. One world, coming to your neighborhood soon. . . .

An ALARA "Get-together" in September, 1984. L to R, front to back: VK–3DML, 2DIX, 7HD, 3DMS, 5ANW; 2DJO, 2PSC, 6YF, 3DVT, 5BYL; 3VAN, 4ACJ, 2PXS, 3VBK, 5YJ; 5AOV, 3NLO, 2KFQ, 3BIR, 3KS; and Muriel May, 5QO and 3AYL. (Photo courtesy of Betken Productions)

AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

ALARA

On the 30th of June, 1975, a group of women interested in amateur radio met in Melbourne and formed the Ladies' Amateur Radio Association, now A(ustralian) LARA. Norma VK3AYL (now VK2DJO) was foundation president. With more than 200 members today, ALARA's main aim has been to encourage the active participation of women in amateur radio. ALARA has an award, contests, trophies, numerous nets, and a quarterly newsletter.

The official net is on ±3.580 MHz at 1030 UTC Mondays (1000 during daylight saving time), linking YL operators all over Australia. The net allows YL newcomers to try their hand—to overcome mike shyness and say hello. All are welcome. The monthly meetings are held on the net on fourth Mondays (except in December).

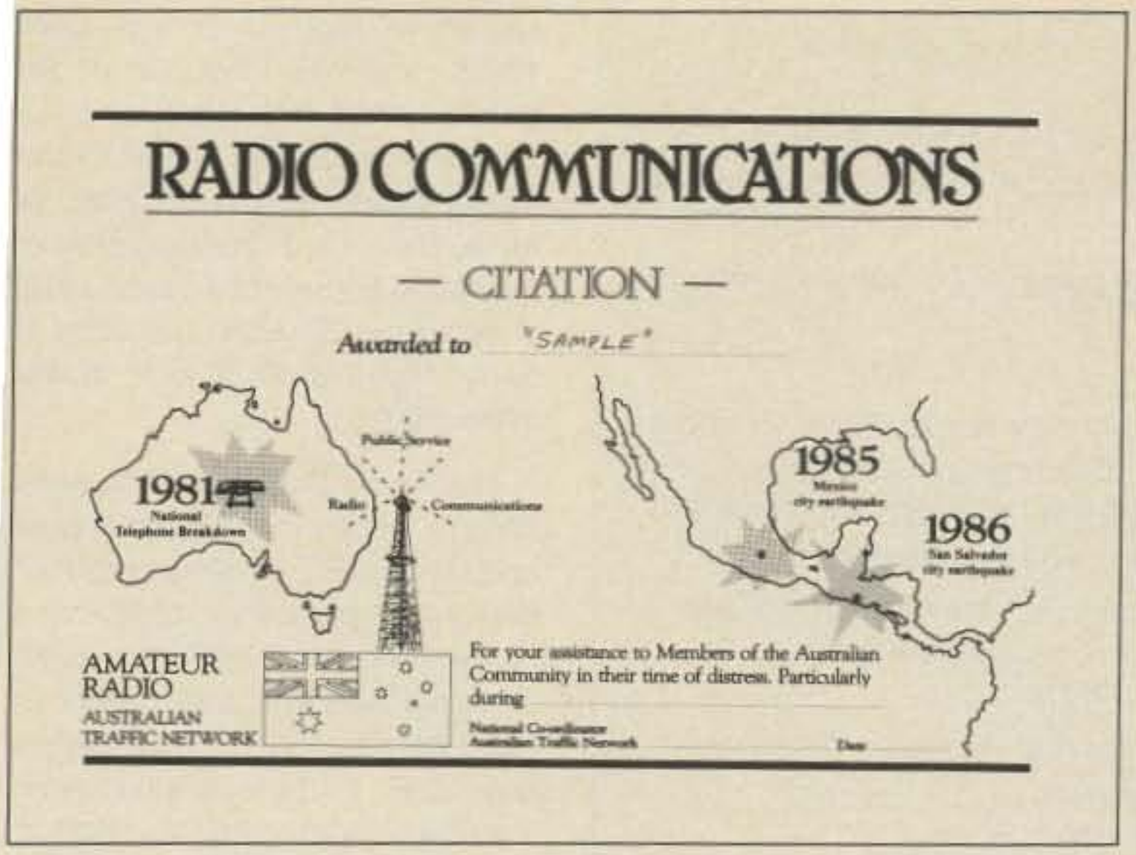
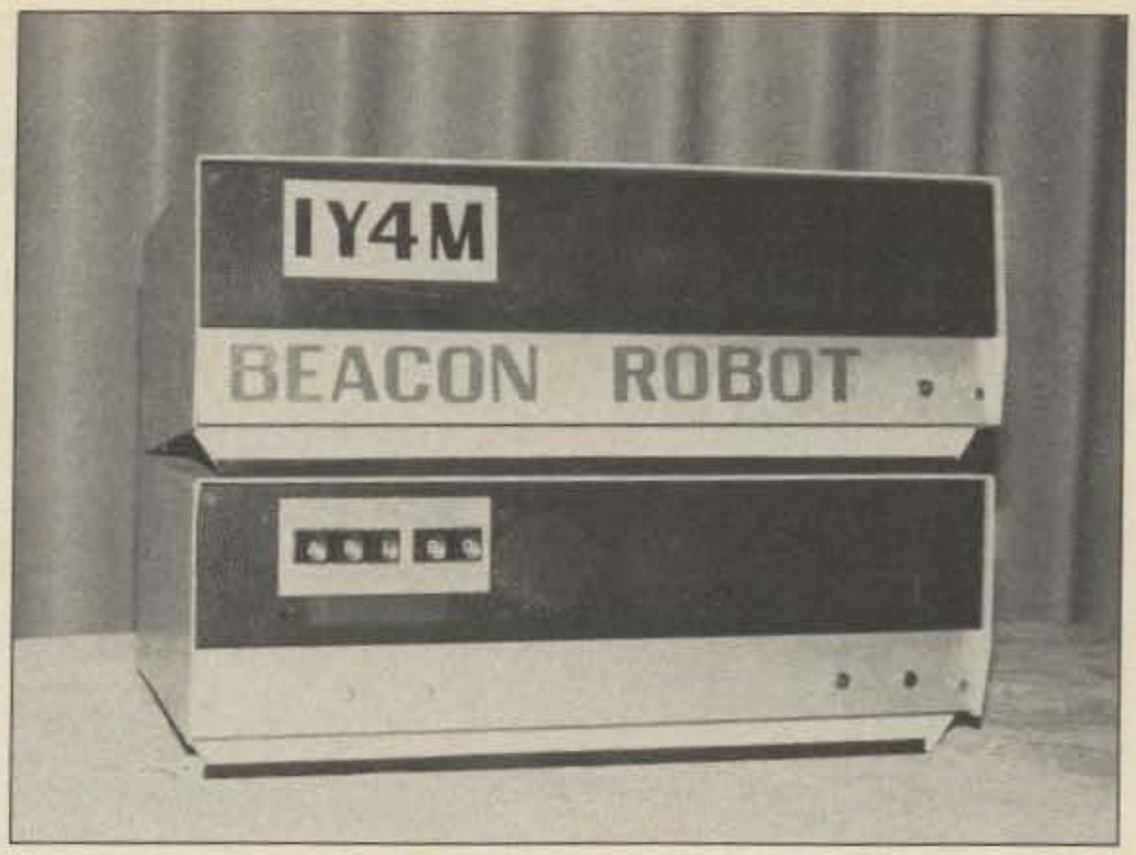


Fig. 1.



Beacon robot IY4M.

Other nets, conducted by ALARA or other YLs, include:

- YL DX "220" net, Mondays, 0600 UTC, 14.220 MHz.
- "Open House" System, Tuesdays and Thursdays, 0900–1200 UTC in winter and 1000–1300 in summer, ±14.332 MHz.
- 15-meter net, Fridays, 0400 UTC, 21.188 MHz.
- Queensland net, Wednesdays, 1000 UTC, ±3.563 MHz.
- WA ALARA/YL net, Mondays, 1200 UTC, ±3.585 MHz.
- CW: Wednesdays, 0430 UTC, 7.030 MHz (VK3KS, VK2SU), and Mondays, Thursdays, Fridays, 0300 UTC, 14.050 MHz (VK3KS, VK4BSQ, VK4ATK).

ALARA has its own song and much recruitment material. They have their own lapel badge, charms suitable for necklaces, bracelets, etc., and teaspoons (and sugar spoons) with their emblem (a great collector's item). When a member signs off, the farewell is "33." This was originated by Clara W2RUF (SK) and adopted by the American Young Ladies Radio League for exclusive YL use; it means friendship between YLs.

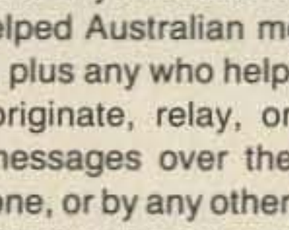
Interested YLs may write to: The Treasurer, ALARA, PO Box 4, Middle Brighton, Australia 3186.

I am indebted to the ALARA Publicity Officer, Joy VK2EBX, for most of this information.

* * * * *

A Radio Communications Citation. VK2BVS writes that by now citations have been sent to all persons and organizations in the amateur radio field who were known to have helped handle Australian messages during (1) the national Australian telephone breakdown, 10–17 June 1981, and/or (2) the Mexico City earthquake disaster, 21–25 September 1985, and/or (3) the San Salvador City earthquake disaster, 11–19 October 1986. Inevitably, however, in operations of such magnitude, participants may be overlooked, be unknown, or have moved or changed callsigns since. Therefore, the citation is now being offered as a general award. Eligible are all Mexican radio amateurs involved in 1985, all El Salvador amateurs involved in 1986, and any overseas amateurs who helped Australian messages to flow, plus any who helped amateurs originate, relay, or deliver such messages over the air, by telephone, or by any other means, or provided updates to national or governmental organizations or to the media. This includes assistance at net control or relay stations, CB operators delivering or collecting local-area messages, and members of the general public whose special help has been acknowledged.

To obtain the citation (see Fig. 1), send details of your involvement together with $5 to Sam Voron VK2BVS, 2 Griffith Avenue, Roseville, N.S.W., Australia 2069.



FEDERAL REPUBLIC OF GERMANY

Ralf Beyer DJ3NW
Opferkamp 14
3300 Braunschweig
West Germany

Frequent short-skip conditions on 10 meters gave dozens of amateurs in Europe a chance to log on the Italian beacon robot, IY4M, recently. So it is time to get ready to contact the robot from other continents, too, in case of short band openings now and then and generally better conditions to be expected in the long run.

The beacon is sponsored and managed by the Associatione Radioamatori, Sezione di Bologna, Italy. It is dedicated to the remembrance of the great Italian scientist and pioneer, Guglielmo Marconi, who established the first radio contact over the Atlantic on December 12, 1901, between Newfoundland, Canada, and Poldhu, in Cornwall, England. The beacon is near the Villa Griffone at Pontecchio Marconi, in Bologna, Italy, where young Guglielmo made his early radio experiments, and from where the first radio signals originated.

Purposes of the beacon include: to serve as a reference for propagation studies and antenna tests, as a signal source for receiver checks, and to broadcast information and bulletins of general interest. Another rather unique purpose is to communicate with users and collect data on stations that operate the beacon. Normally, a computer and modem are required to get in contact with such a machine. IY4M, however, communicates in Morse code, so everyone is ready for a QSO with him.

IY4M operates on 28.195 MHz in CW with a normal output power of 20 Watts and a 5/8-wave ground-plane antenna. It identifies itself by sending IY4M twice, followed by the intermittent signal (------- --- ------- --) followed by the message, IY4M ROBOT QRV QRV, at 15 wpm code speed. If a command is received within 30 seconds, it will be executed by the machine; otherwise, the cycle repeats. The robot adapts automatically to your code speed, which may be within the range of 10 to 50 wpm: it answers at the same speed with which it is approached by the user. The bandwidth of the receiver is about ±2590 Hz, centered on the nominal frequency of 28.195 MHz.

A short QSO with the robot is initiated by sending on his frequency in CW a message like:

IY4M IY4M DE DJ3NW DJ3NW K

The robot checks the syntax of the callsign received. For instance, if you send HELLO instead of your call, the robot will answer:

HELLO HELLO ? ? PSE AGN

If a correct call is received once only, the robot answers:

DJ3NW DJ3NW ? ? PSE AGN

If the robot doesn't understand the call at all, it answers:

? ? PSE AGN

If the initiating message is accepted, the robot answers:

DJ3NW DJ3NW DE IY4M—HR OP ROBOT—TKS FER CALL NW STORED IN MEMORY—NW PSE SEND SIG ES WL GIVE U RPRT BK.

At this point, send a signal (dots, dashes, or carrier) for about four seconds. The robot then answers (for example), R UR RST IS 55 55, and asks, NW PSE MY RST RST ? ? BK, and expects that you will give a report (RST) at least twice, ending with a well-spaced letter K. The robot then answers, R R TKS FER (RST) and terminates the QSO by saying good-by in one of these languages, selected according to your callsign: English, Italian, Spanish, French, German, Swedish, Finnish, Japa-

Keyword	Response	Action
QRP K	IY4M QRP PWR 2W OUT	Output power is switched to 2 Watts and is reset to 20 Watts again if the robot identifies itself.
QRO K	IY4M QRO 20 W OUT	Normal output power of 20 Watts is restored.
QTG K	An intermittent signal is sent for about 15 seconds.	
QSA K	R R	The user should now send a signal for about 4 seconds, and the robot responds, for example, UR S 5 5, or SRI NIL if the received signal is inadequate for some reason.
QTC? K	QTC ... / ... / ... STORED	Robot tells you which messages (1–5) are currently stored, or it answers, NO QTC STORED.
QTC 1 thru 5 K		Robot transmits the requested QTC at the user's code speed, but not slower than 18 wpm.
INFO K	IY4M AT (hour and date in UTC) FQ 28195 KHZ QRO (QRP) 20 (2) W OUT ANT GP 5/8 LOC JN54OK CODE SPEED ... WPM ... TEMP (MINUS) ... C	
LIST K	V V V LIST OF QSO AT (hour and date in UTC) followed by a list of all QSOs stored, at 50 wpm.	Each entry is listed by time, date, callsign, RST sent or ?, RST received or ?, and robot output power: 0–20 Watts, P-2 Watts.
LIST L K	Same but at 30 wpm	
MSG 1–4		Transmission of a stored message at your code speed but not less than 18 wpm. MSG1: list of keys; MSG2: list continued; MSG3: How to operate the robot; MSG4: Guglielmo Marconi celebrating message.

Table 1. Commands accepted by IY4M.

nese, Serbo-Croat, Russian, and Portuguese.

In addition, the robot accepts a number of keywords and responds to them—see Table 1.

You can operate the robot quite easily if you follow these recommendations:

•To be sure you are heard by the robot, send some Vs followed by a well-spaced letter K. The robot answers, ? ? .

•Sending a couple of Vs at the beginning of each transmission helps the robot to synchronize with your speed.

•Each key can be repeated several times to cope with QRM. However, the time limit for a command is 30 seconds.

•End each command with a well-spaced letter K. If the robot does not respond, he may not have received the K properly. Send another K. Otherwise, start all over again.

•Keywords and callsigns must be transmitted without spaces. DJ3NW rather than DJ 3 NW, for example.

A special QSL card is sent to all stations logged by the robot.

Beacon robot IY4M was designed and built by IK4BWC, I4DVT, IK4EWK, I4IJY, and I4TNM, with the cooperation of I4ACO, I4BER, I4BUA, IK4CZF, I4NE, I4QHD, and I4TA.

The idea to build the machine came from Marco De Vietro IK4EWK and his father, I4DVT. Two years ago, Marco began with an Apple II computer and a simple program in Forth which was able to decode a CW signal from the computer I/O port, to recognize a command, and to execute it. Later, the gang of IY4M built a dedicated computer, clock, A/D converter, receiver, and interfaces to get IY4M on the air.

There are more features to come. "We would like to build a completely new computer for the robot, based on an MS-DOS operating system," Marco says. "The primary goal [would be] to make the system smarter in recognizing commands and callsigns even with the wrong spacing between letters or words." New commands may include a Morse tutor, a mailbox, or a facility to vary the transmitter output power over a wide range. And PROLOG, one of the artificial intelligence languages, is already considered a candidate to implement the improvements.

I really love to get in contact with IY4M and enjoy the way it provides everyone with access to an intelligent machine by the simplest type of radio communications of all—good old CW. Thanks to the crew of IY4M for a job well done!

And thanks to Marco De Vietro IK4EWK for the information on IY4M.

SRI LANKA

Calvin Fernando 4S7CF
15/6, Albert Perera Avenue
Nugegoda
Sri Lanka

(Welcome to Calvin 4S7CF of the nation of Taprobane (as it was known to the ancients), Serendip (as it was known later), Ceylon (as known in modern times—until 1972), and the Republic of Sri Lanka, as it is known now—a 25,332 square-mile island in the Indian Ocean off the SE coast of India. Calvin is a vice-president of the Radio Society of Sri Lanka and is active on 20 when the band is open. (He has all 50 U.S. states confirmed.)

The Radio Society of Sri Lanka had its annual meeting in August and elected R.E.H. Perera 4S7EP (Earnie) as president, 4S7CF and R. Gunawardene 4S7RR (Ranjit) as vice-presidents, and the following: Ekendra 4S7EF, Hon. Secretary; D.P. Pathmaperuma, Hon. Treasurer; Victor 4S7VK, Editor; and Rodney 4S7RM, Auditor. Committee members are Warne 4S7PW, Ananda 4S7NB, Paul 4S7PVR, Cecil 4S7CD, Vasantha 4S7VG, A.C.S. Jayaranjan, and H. Buddadasa.

Amateur radio is more than 50 years old in Sri Lanka, and is growing slowly. About 150 hams are licensed, of whom about 30 are active, a few of them DXers. The RSSL issues a Worked Ten 4S7 Stations award to any licensed amateur. (Send 10 IRCs and certified log extracts to Awards Manager RSSL, PO Box 907, Colombo, Sri Lanka.) The QSL bureau is also at this address.

A license to operate may be issued to visiting hams if application is made at least three months before arrival [Calvin offers his help; contact him]. No third-party traffic is permitted.

Most hams visiting Sri Lanka visit our society get-togethers. Recent interesting visitors included OM Karl DDJ2NH, who donated the only 2m repeater, at present (receives on 145.000 MHz, transmits on 145.60), and OM Minoru JA3MNP, who has sent us about 25 2-meter rigs collected from JA hams as presents for our hams.

We have never had visiting DX-pedition groups, but it will be a good idea. If you will let us know specific plans, I can put it up to the RSSL and see how we can give our cooperation. Our club station uses 4S0AA during the All Asia DX Contest.

I like your magazine very much but it is very seldom that we see a copy. Best 73. . . .

A one-year subscription has been entered for the RSSL as "International's" foreign correspondent, through its representative, 4S7CF.

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174

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SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S–155 00 Nykvarn
Sweden

CEPT LICENSE

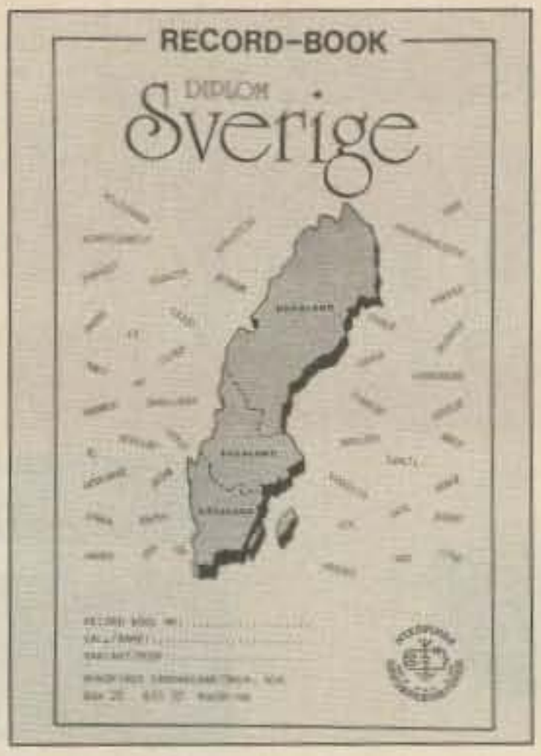
By the time you read this, the European License according to the CEPT Agreement should have been accepted by the Swedish Telecommunication Authority. This will mean that amateurs in those European countries that have accepted the CEPT Agreement no longer have to apply for a reciprocal license when traveling on vacation and bringing the radio with them. I will confirm this in a future report and give specific information on which countries this applies to. Others must continue to follow the reciprocal licensing procedure.

THE SWEDEN AWARD

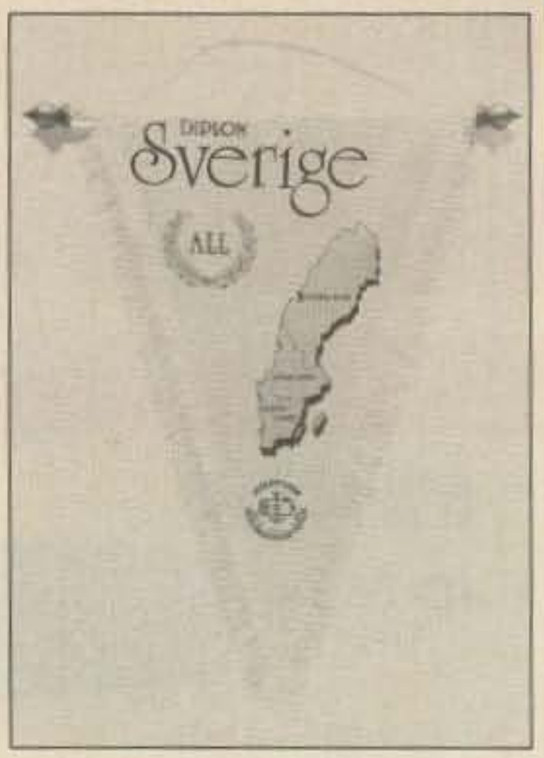
We all know that amateur radio is a greatly diversified avocation. Regardless of our prime interest within the field, we sooner or later get into the game of hunting for awards. At one time, it seemed like every radio club was running its own award. Some awards are regarded as very prestigious, while others may be just a nice decoration hanging on the wall.

Some seven years ago, the Sweden Award was established by the radio club Nykopings Sandareamatorer. The prime purpose was to increase the low amateur activity on the 80-meter band. More or less to everybody's surprise, this activity has been ever increasing throughout the years and has attracted more and more amateurs. It also has developed into more than just hunting for an award. Those who take part become very good friends and even arrange annual meetings which have become very well liked.

Collect 100 Parishes. The smallest administrative geographical area in Sweden is a parish. In all there are 2,563 parishes, but for the Sweden Award, you must work only 100 different ones. If you are trying for additional stickers or even heading for "Worked All Swedish Parishes," you must follow the mobile activity going on. The most amazing thing with this award has been the increasingly big mobile activity. The performance of the mobile setups is astounding. It has even been possible for stations in the most southern part of Sweden to work mobile stations north of the Arctic Circle on the 80-meter band, a distance of 1,500 kilometers (940 miles). Summertime and Midnight Sun have not really favored the propagation on these low frequencies, but the avid award hunters have done it anyway.



The Record Book cover.



The pennant awarded for working all parishes.

Another thing to be pointed out is the operating technique that has been developed. It reminds us a lot of a DX pileup, but here it is mandatory that each station giving a report also repeats the report received. Very often somebody else keeps the log when a mobile station is involved in the activity. You may, however, collect parishes during regular QSOs which, of course, are valid for the award.

For many amateurs it is a learning experience of many kinds to take part in this award-hunting activity. One is that you have a chance to get a good knowledge of Swedish geography. It is very interesting to look up on a map to find out where the station you worked is located.

U.S. County Award Similarities. The Sweden Award has similarities with the very popular U.S. Counties Award [sponsored by *CQ*]. The first one to work all parishes was Nils SMØTW. He is still active helping others to achieve the same goal. The last few years, Elvir SM7HZZ has been the leading enthusiast. He has worked over 15,000 QSOs from 1,300 parishes being mobile! From his home station, he is usually the one directing the net. This last summer, Olle SM6CVL has covered most parts of South Sweden, running mobile from over 1,000 parishes.

Record Book Required. To date, over 1,500 Record Books have been sent out. So far, 61 amateurs have worked all parishes. The first one outside Sweden was Harald LA9VK, who received the Worked All No. 40. A Record Book is required, and has to be sent to the club together with the application for this award. The charge is 35 Swedish Kroner plus postage (approx. U.S. $5 plus postage). Send for further information from NSA Diploma Manager, Box 25, S–6ll 22 Nykoping, Sweden.

A QSL card exchange is not required for this award, but NSA reserves the right to examine log entries. All Record Books are given an ID number. All amateur bands and modes may be used to work Swedish stations, although the most popular frequency for mobile activity is 3,760 kHz. There also is a special mobile trophy and a CW trophy. After the minimum 100 parishes required for the basic award, there are stickers for 500, 1,000, and ALL. A beautiful pennant is issued when all parishes have been worked.

Although this award is, of course, easiest to achieve for amateurs in Sweden and its neighboring countries, there are quite a few Record Books in other European countries and in the U.S. Why don't you start collecting parishes? In Swedish, a parish is called a *forsamling*. When you work CW, ask for the "FG." Write for your Record Book and for all the information you will need for the Sweden Award.■

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The size, price and performance of these new instruments make them indispensible for technicians, engineers, schools, Hams, CBers, electronic hobbyists, short wave listeners, law enforcement personnel and many others.

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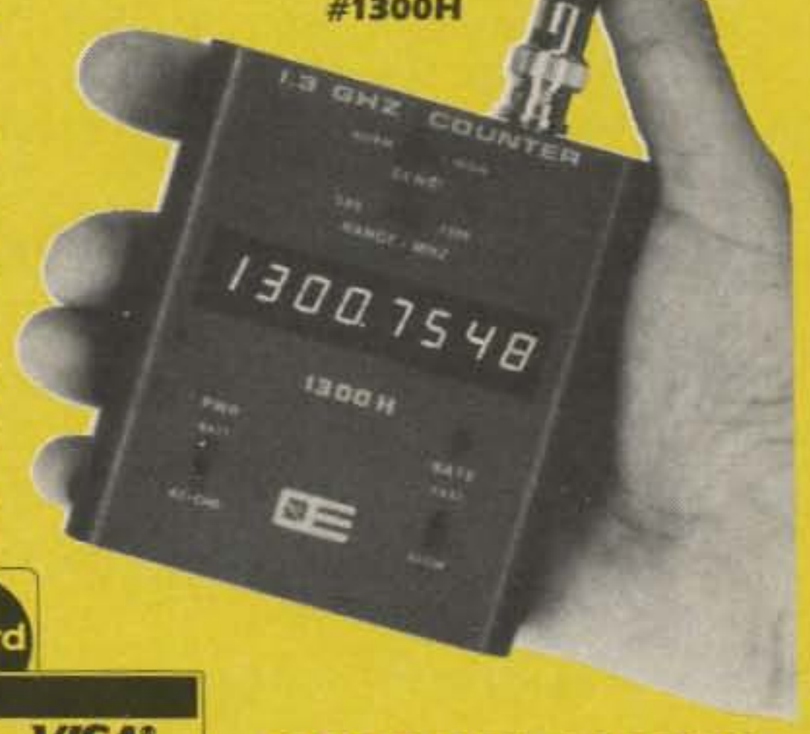

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April 24, 25, 26, 1987

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• Giant 3 day flea market • Exhibits
• License exams • Free bus service
• CW proficiency test • Door prizes

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Award Nominations: April 4
Lodging: April 4
License Exams: March 28
Advance Registration and banquet:
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Canada - April 4
Flea Market Space:
Orders will not be accepted **before** January 1

Information

General Information: (513) 433-7720
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(No Reservations By Phone)

HAMVENTION is sponsored by the Dayton Amateur Radio Association Inc.

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(Please attach your name, address, and telephone number to this form.)

Dayton Hamvention – April 24, 25, 26 1987
Reservation Deadline – April 4, 1987
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1986 15/20-METER SSB CHAMPIONSHIP RESULTS

DL6FBL, N5TR, and K5LZO —20-Meter World Champions—

Superbowl Syndrome! That was the order of the day as dedicated contesters worldwide chose to take to the airwaves instead. Normally we would have scheduled the 80- or 160-meter events on this football weekend, but the NFL announced their schedule much later in the season than they normally do. *73* had already scheduled the contesting events.

Despite the odds, DL6FBL literally walked away with World Championship honors. His single-operator DX entry included 1,180 QSOs, 55 states and provinces, 108 DX countries, and 1,801,150 contest points! Fantastic score—the highest in the contest! Great job, Ben!

This year's runner-up is a newcomer to

Overall Winners—Single Operator:			
USA	NR5M	85	1,082,950
Canada	VE3BVD	86	645,465
DX	DL6FBL	86	1,801,150
Overall Winners—Multi-Operator:			
USA	K5LZO	85	932,815
DX	GW4EZW	86	109,620
W/VE Stations—Single Operator:			
AR	WB5KED	86	82,565
CA	WA6FGV	85	268,800
CO	W0IZV	85	34,400
CT	KA1YR	86	233,100
DE	AC3T	85	60,672
FL	K4XS	85	296,825
GA	WS4N	86	62,640
IA	KD0HY	85	41,520
IL	W9REC	86	3,850
IN	KB0C/9	85	1,380
KS	WB0WHB	85	191,100
KY	KI4UJ	86	36,960
MA	KA1GG	86	916,380
MD	N3AOE	85	29,250
ME	KR2K/1	85	1,875
MI	N8CXX	85	145,140
MN	W0NGB	86	7,425
NC	KF4HK	86	55,000
NE	KV0I	86	211,670
NH	AF1T	85	50,840
NJ	WB2ULI	86	793,860
NM	AI9X	86	22,500
NY	KA2VAJ	86	33,250
OH	WD8DVX	86	38,850
OR	NI7T	85	296,400
PA	W3ARK	86	41,370
TX	NR5M	85	1,082,950
VA	W4WJJ	85	117,410
VT	W3SOH	86	7,250
WA	N7BES	85	425,655
ALT	VE6CPP	86	32,745
NS	VE1BDT	85	164,900
ONT	VE3BVD	86	645,465
W/VE Stations—Multi-Operator:			
CT	KA1YR	85	360,500
IN	KE9T	86	453,600
KS	WB0OIZ	85	96,460
LA	KD5RW	86	266,900
OR	NK7U	86	435,590
TX	K5LZO	85	932,815
WA	KE7C	85	559,860
WY	KB7M	85	20,125
DX Stations—Single Operator:			
Alaska	KL7U	86	141,345
Australia	VK2BQS	85	16,500
Balearic	EA6VQ	85	222,950
Brazil	PT2TF	86	114,700
Bulgaria	LZ1YEW	85	272,480
Canary Is.	EA8VV	86	32,760
Czech.	OK1RI	86	555,660
Hawaii	KH6DW	86	623,310
Honduras	HR1FC	85	15,225
Indonesia	YB0ZEA	86	270
Israel	4X6IF	86	140,800
Italy	I4UFH	85	164,125
Japan	JK1MAZ	85	186,260
New Caledonia	FK8FA	86	120,750
Portugal	CT1DIZ	86	3,440
Puerto Rico	KP4FI	86	749,840
Scotland	GM4WEW	85	4,600
Spain	EA3BOX	86	128,076
Sweden	SM7NNJ	85	9,450
UN HQ	4U1UN	85	4,880
Wales	GW4BLE	86	612,720
W. Germany	DL6FBL	86	1,801,150
Yugoslavia	YU7SF	86	1,100
DX Stations—Multi-Operator:			
England	G4CVK	86	35,550
Finland	OH7AI	86	31,785
Japan	JA7YCQ	85	38,340
Wales	GW4EZW	86	109,620

Table 1. 20-meter honor roll—all-time record holders. (Columns show QTH, callsign, year, and score.)

World 20-meter single-op DX champion DL6FBL.

20-meter DX single-op runner-up AH6GQ.

the contest community. She promises to be a threat any time she's on the band. Meet Helen AH6GQ. This was Helen's first or second (can't remember which) contest entry. Heard her a few weeks later, and she was among the top WPX scorers, too!

Station N5TR, operated by WB5VZL, is the World Champion for W/VE single-operator stations. George's station accumulated 1,349 QSOs. His Q-count and DX country totals (70) were more than runner-up station KA1GG could handle. A total of 21 multipliers separated the two.

Chuck K5LZO is the Multi-Op World Champion for the second consecutive year. Chuck worked more stations (1,365) than any competitor. Together with 55 states and provinces and 56 DX countries, a total of 842,490 contest points were tallied.

So here is what the record book looks like at the end of our second annual 20-Meter World Championship event:

	1985	1986
W/VE Single Operator:	NR5M	N5TR
DX Single Operator:	OK1TN	DL6FB
W/VE Multi-Operator:	K5LZO	K5LZO

Each year brings new champions. Here is a glance at the top-ten QSO record holders for 20 meters:

Single Operator:

NR5M	1985	1,690	
N5TR	1986	1,349	
KA1GG	1986	1,193	
DL6FBL	1986	1,180	
AH6GQ	1986	1,139	
KP4FI	1986	984	
VE3BVD	1986	943	
KA1GG	1985	924	
W5FO	1985	913	
W1BR	1985	904	

Multi-Operator:

K5LZO	1985	1,473	
K5LZO	1986	1,365	
KE7C	1985	1,171	
NK7U	1986	898	
KE9T	1986	601	
KD5RW	1986	576	
KA1YR	1985	501	
KD5RW	1985	411	
WBØOIZ	1985	343	
GW4EZW	1986	216	

K5LZO led the pack with 1,365 QSOs. Following him with 500 or more contacts were: N5TR (1,349), KA1GG (1,193), DL6FBL (1,180), AH6GQ (1,139), KP4FI (984), VE3BVD (943), NK7U (898), KH6DW (808), WB2ULI (720), GW4BLE (707), KVØI (676), WA6FGV (671), OK1RI (588), and KD5RW (576).

Certain states and provinces were at a premium. Canadian participation was extremely rare on the East Coast. Nobody managed to work all 61 multipliers. N5TR came the closest with 57. Others with 50 or more included: DL6FBL, K5LZO, and KE9T each with 55; KA1GG and AH6GQ with 54; KH6DW and WA6FGV with 52 each; KP4FI (51), and WB2ULI (50).

There were a lot of DX stations on the air this year. Unfortunately, the stateside turnout was extremely low because of the Superbowl. So if you missed a new one, blame it on Pete Rozelle! Stations with 50 or more DX countries included: DL6FBL (108), WB2ULI (81), N5TR (70), OK1RI (68), KP4FI (61), JK1MAZ (59), VE3BVD (57), K5LZO (56), KA1GG (54), KE9T (53), and GW4BLE (52).

Though participation was lower than anticipated, we did see some world records broken. Many contestants became leaders in

Single Op:				
DL6FBL	West Germany	TS-930S	Alpha 77DX	6 elements at 100'
AH6GQ	Hawaii	TS-430S	Harris/RFC	5 elements at 70'
N5TR	Texas	TS-930S	Alpha 77D	4 elements at 200'
				5 elements at 175'
				5 elements at 100'
KA1GG	Massachusetts	TS-940	H.B. 8877	3 elements at 110'
				3 elements at 55'
WB2ULI	New Jersey	TS-530S	Clipperton-L	4 elements at 80'
Multi-Op:				
K5LZO	Texas	TS-430S	Alpha 77D	5 elements at ?
				4 elements at ?
KE9T	Indiana	TS-430S	MLA-2500	6 elements at ?
NK7U	Washington	TS-930S	Alpha 78	Unknown
KD5RW	Louisiana	FT-901DM	SB200	4 elements at 100'

Table 2. Equipment of the top-five single- and multi-op 20-meter stations.

1986 20-METER WORLD SSB CHAMPIONSHIP

Callsign, QTH, QSOs, states and provinces, DX countries, total score

** = World Champions; * = State, Province, Country Champions

W/VE—Single Operator:

** N5TR	TX	1,349	57	70	1,007,745
* KA1GG	MA	1,193	54	54	916,380
* WB2ULI	NJ	720	50	81	793,860
* VE3BVD	ONT	943	54	57	645,465
* KA1YR	CT	429	35	35	233,100
* WA6FGV	CA	671	52	12	224,000
* KVØI	NE	676	42	19	211,670
* KC7QP	WA	448	45	25	185,150
* NØCLV	KS	332	39	11	84,000
* WB5KED	AR	330	42	7	82,565
* WS4N	GA	156	34	24	62,640
* W4WKQ	FL	212	33	17	59,250
* W5PWG	TX	266	39	4	57,190
* KF4HK	NC	145	29	26	55,000
K5ZD/1	MA	160	32	16	51,120
* AF1T	NH	213	42	0	44,730
* W3ARK	PA	164	29	13	41,370
* WD8DVX	OH	158	24	18	38,850
* KI4UJ	KY	101	30	26	36,960
* KA2VAJ	NY	103	31	19	33,250
* VE6CPP	ALT	170	33	4	32,745
* AI9X	NM	123	32	4	22,500
KJ4LU	NC	83	21	14	19,425
WK4F	FL	63	27	11	13,870
K4GKV	GA	55	19	16	13,475
WA5IYX	TX	55	28	3	8,835
WØNGB	MN	49	23	4	7,425
W3SOH	VT	44	21	8	7,250
WE6G	CA	45	26	3	6,960
WØIZV	CO	35	31	4	5,265
W9REC	IL	30	16	5	3,850
N5AFV	TX	28	15	4	2,945
NF2C	NJ	20	11	2	1,300
K5GN	TX	7	6	0	210

(Checklog: KJ4NC, AE6T.)

DX—Single Operator:

** DL6FBL	West Germany	1,180	55	108	1,801,150
* AH6GQ	Hawaii	1,139	54	49	1,083,045
* KP4FI	Puerto Rico	984	51	61	749,840
KH6DW	Hawaii	808	52	27	623,310
* GW4BLE	Wales	707	40	52	612,720
* OK1RI	Czechoslovakia	588	40	68	555,660
* JK1MAZ	Japan	299	8	59	186,260
* KL7U	Alaska	263	49	32	141,345
* 4X6IF	Israel	266	16	39	140,800
* EA3BOX	Spain	248	33	19	128,076
* FK8FA	New Caledonia	273	10	40	120,750
* PT2TF	Brazil	184	28	45	114,700
* EA6TC	Balearic Is.	198	10	23	36,630
EA7AVU	Spain	170	12	25	34,040
EA8VV	Canary Is.	84	34	5	32,760
GØASM	England	77	11	23	18,360
I4CSP	Italy	59	16	19	17,850
JA2MNB	Japan	60	6	21	14,985
JA1BNW	Japan	62	4	21	13,875
JE1AER	Japan	32	2	16	5,040
OK3YK	Czechoslovakia	27	8	10	4,300
CT1DIZ	Portugal	35	5	11	3,440
LZ1BG	Bulgaria	27	2	10	1,800
JH3DEJ	Japan	15	1	12	1,625
YU7SF	Yugoslavia	15	2	9	1,100
OK1KZ	Czechoslovakia	10	1	8	810
JA2BNN	Japan	12	3	5	800
EA5EFV	Spain	12	5	2	695
LZ1WY	Bulgaria	10	1	7	480
OK1KUZ	Czechoslovakia	7	4	2	390
YBØZEA	Indonesia	10	0	3	270
JA1AAT	Japan	7	1	3	200
YU7MGU	Yugoslavia	5	2	3	175
JE1GZB	Japan	8	0	3	150

W/VE—Multi-Operator:

** K5LZO	TX	1,365	55	56	842,490
* KE9T	IN	601	55	53	453,600
* NK7U	OR	898	49	37	435,590
* KD5RW	LA	576	49	36	266,900
K7LXC	WA	21	13	2	1,650

DX—Multi-Operator:

* GW4EZW	Wales	216	32	31	109,620
* G4CVK	England	105	22	23	35,550
* JA9YBA	Japan	102	7	27	32,810
* OH7AI	Finland	139	7	32	31,785
JA2YEF	Japan	45	5	20	11,310

(Checklog: JA3YKC.)

Multi-Operator Participants:

G4CVK	G4IEB, GØAGH, G4XOM
GW4EZW	GW4EZW, ?
JA2YEF	JI2LPD, JI2QVF, T. Yamamoto
JA3YKC	JR6NWN, JI3ERV
JA9YBA	JH7UJR, JA9LNJ, JA9VDA
K5LZO	K5LZO, KE5IV, NT5D, NM5M
KD5RW	KA5DLM, KA5BOO
K7LXC	K7LXC, KB7TAD
KE9T	KE9T, WB9YBI, N9FGM
NK7U	NK7U, NI7T
OH7AI	OH7BY, OH7EV, OH7HK, OH7UV

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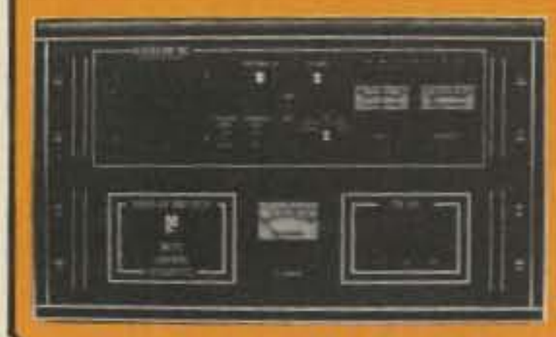

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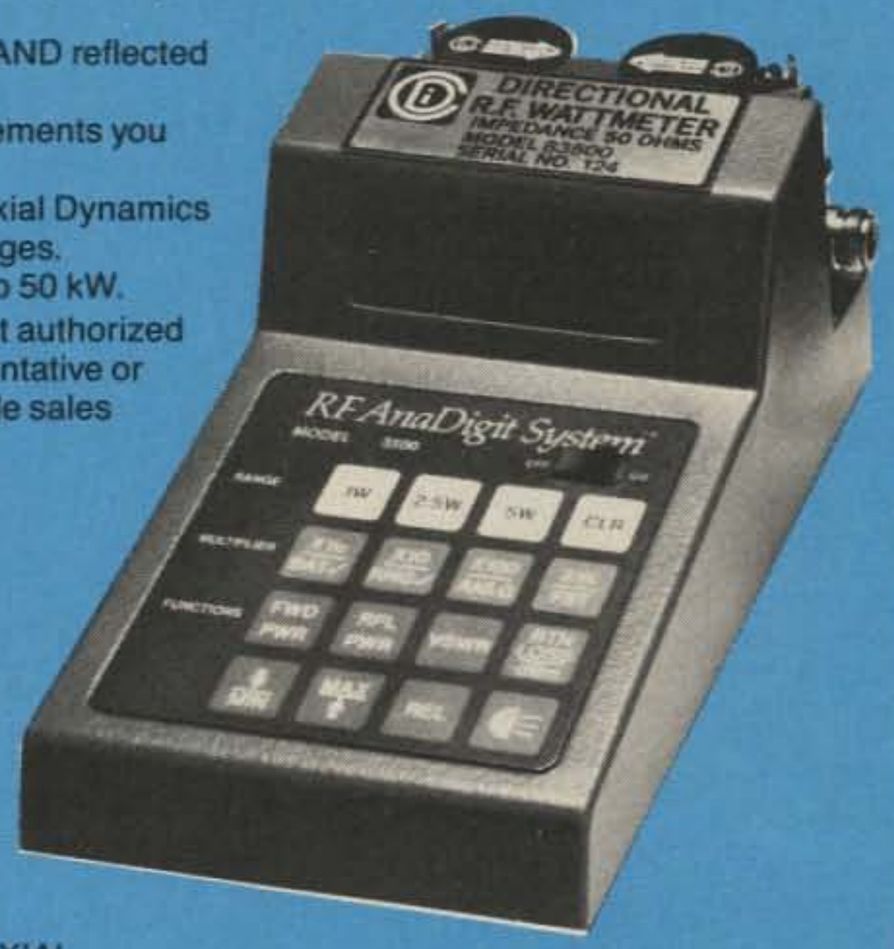

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20-METER SOAPBOX

4X4IF	Never recalled a contest in which I worked so hard and did so poorly. Conditions were simply awful. We'll certainly welcome the return of the sunspot maximum.
AH6GQ	Had no plans to enter the contest, just participate. After two hours, I decided to go for it and had lots of fun!
DL6FBL	Thanks for the contest! The greatest was the big number of exotic DX stations. I worked countries I have never heard before in a contest.
EA6TC	The antenna rotor was torn because of 45-kph winds.
GØASM	Conditions were quite good considering the sunspot cycle.
GW4BLE	Enjoyed the contest. Like the 24-hour format.
KA1YR	Great contest. More participation this year. Looking forward to next year.
KJ4LU	20 meters with 100 Watts in a contest is like working QRP with a half-wave dipole in the basement.
KH6DW	I believe in ten hours of operating I worked everyone who could hear me and everyone I could hear. I certainly will be back next year.
KE7C	Superbowl got in the way this year! Usually 80- or 160-meter contests are run on Superbowl Sunday. Guess we goofed up the schedule. Promise to resolve the problem in '87.
KVØI	Propagation sure was lacking to Europe and JA from the Midwest.
KP4FI	Nice to work the contest. My first SSB contest.
WB2ULI	Superbowl + TVI don't mix!
W4WKQ	Enjoyed this 20-meter event better than any other SSB contest on the band.
YU7SF	This is my 1,005th contest and first 20-meter phone!

their respective state, province, or DX country. Analyze the 20-meter honor roll (Table 1). Enter your station next year and perhaps your name will be among those mentioned!

It seems on 20 meters that if you don't have the skies filled with aluminum, you'll never make the grade. In this contest, there is no room for compromises. You need a good operator, lots of aluminum, a rig that will filter the QRM, and at least 1,500 Watts to meet the competition head-on. Table 2 shows what the top stations were running.

I don't know what you do during the summer, but around here it is antenna weather. I now have three 5-element arrays up for 20 and a tribander just for standby. I'll see how they play in '87. As for the rest of the contesters, here is a sampling of the antennas they used on 20 meters during the '86 event and their percentages:

3-element yagi	26.5
4-element yagi	16.5
6-element yagi	16.5
Inverted vee/dipole	12.0
Vertical	10.5
5-element yagi	9.5
7-element yagi	4.5
2-element quad	1.5
2-element yagi	1.5
Delta loop	.5
4-element quad	.5

From these statistics, it looks as if I'd better upgrade my system just to stay up with the rest of the field. Where are all the tribanders? Last year they represented 45% of the configurations in use. Hmm, very interesting! You think maybe they upgraded to monobanders?

We all owe our gratitude to Chuck WA6R, our 20-Meter Contest Chairman. Chuck, like our other contest committee members, has the thankless job of tallying all the entries, issuing the certificates, catching flack when your score fails to show up in the magazine, and filling out all these ridiculous reports about his contest committee activities as the months go by. If you had a good time, thank Chuck; he's the one responsible. In 1987, who knows, he may open up a new category for hooking the big ones. Thanks, Chuck.

KM5X, K5LZO, OK1RI, and KH6DW —15-Meter World Champions—

It was another Texas showdown. While the majority of the world suffered with poor band conditions, stations in Texas were nabbing contacts like they were going out of style. As the sun set in the west (2400 UTC), the stations in Texas clearly took home the bacon!

KM5X is World Champion in the single-operator category. Following with his very close and exciting second was NR5M. At the finish, only eight QSOs separated the two stations. KM5X had the advantage of ten additional multipliers to take the overall lead by 80,000 points. VE3BVD became the highest scoring Canadian station, finishing 3rd in the single-operator class.

OK1RI became the World Champion for DX single-operator stations by earning a respectable 441,600 points, including 65 DX countries worked. Comparing all contest entries, OK1RI had the second highest score in the world. A superb effort from our most sought-after European friend. Great job! JG1FVZ/5NØ took a commanding second-place finish by handing out Nigerian multipliers to the deserving 333 stations he contacted. Our thanks for this African entry.

K5LZO retains his title by becoming the World Multi-Op Champion for the second consecutive year. Chuck, another Lone Star station, is a fierce competitor. Not only has he dominated this event since its inception, Chuck is also the World 20-Meter Multi-Op Champion. Need I say more?

Well-known Hawaiian station KH6DW, with an assist from K7SS, took the World Multi-Op Championship in the DX class. Frank and Danny went unchallenged throughout the event. For the most part, propagation seemed poor to most parts of the world. While multipliers were at a premium, they managed to make 618 contacts, the most stations worked by any competitor. As usual, great job, guys! You're a class act!

Analyzing this year's results, here are the current top ten world 15-meter QSO record holders:

Single Op:				
KM5X	TX	TS-940S	Alpha 77D	5 over 5 Telrex at 135'/190'
OK1RI	Czech.	FT-102	HB 500W	4 elements at 72'
NR5M	TX	TS-930S	Alpha 77D	6 over 6 KLM at 80'/115' 6-element KLM at 95' 5-element Hy-Gain at 45'
VE3BVD	ONT	TS-930S	SB-220	5 over 5 at 70'/140'
JG1FVZ/5NØ	Nigeria	TS-120S	FL2100Z	4-element triband yagi
Multi-Op:				
K5LZO	TX	TS-430S	Alpha 77D	6-element KLM at 145' 6-element KLM at 54'
KH6DW	HI	TS-930S	TL922A	6-element KLM at 70'
KD5RW	LA	FT-901DM	SB-200	4-element KLM KT34A at 100'
WD5GSL	TX	S-Line	Alpha 76	13-element log periodic

Table 3. Equipment of the top-five single- and multi-op stations.

Single Operator:

K4XS	1985	706
KM5X	1985	583
KM5X	1986	548
NR5M	1986	540
WA6FGV	1985	511
K7QQ	1985	463
WA7CQE/DV2	1986	461
K4VXO	1985	434
VE3BVD	1986	404
JG1FVZ/5NØ	1986	333

Multi-Operator:

K5LZO	1985	759
KH6DW	1986	618
K5LZO	1986	521
WD5GSL	1985	394
KD5RW	1986	298
KD5RW	1985	295
WD5GSL	1986	228
KE7C	1985	206

As mentioned, multipliers were at an absolute premium. Leading the pack with state and provincial tallies were NR5M (50), KM5X (49), K5LZO (48), KC2EE (44), KD5RW (42),

Overall Winners—Single Operator:

USA	K4XS	85	514,000
Canada	VE3BVD	86	225,640
DX	OK1RI	86	441,600

Overall Winners—Multi-Operator:

USA	K5LZO	85	457,960
DX	KH6DW	86	333,575

W/VE Stations—Single Operator:

AL	KB4JSS	85	2,700
AR	W5EIJ	85	1,755
CA	WA6FGV	85	151,840
CO	WØIZV	85	3,135
DE	AC3T	85	50,235
FL	K4XS	85	514,100
GA	K4GKV	86	3,145
IA	KDØHY	85	29,040
IL	K4VX/Ø	85	229,245
IN	W9RE	85	39,270
MD	K3ZO	86	4,590
MI	N8CXX	85	102,510
MN	WØNGB	85	490
MO	WBØOIZ	85	9,750
NC	N4UH	85	31,080
NE	KVØI	86	10,800
NJ	NF2C	86	275
NY	KX2J	86	3,060
OH	WD8DVX	86	3,870
PA	W3ARK	86	3,120
TX	KM5X	86	458,780
UT	NJ7A	86	640
VT	W3SOH	86	3,800
WA	K7QQ	85	175,070
WI	W9XT	85	32,600
WY	KB7M	85	2,665
NWT	VE8RCS	86	140
NS	VE1BDT	85	22,680
ONT	VE3BVD	86	225,950

W/VE Stations—Multi-Operator:

FL	WC4E	85	46,060
LA	KD5RW	86	134,050
TX	K5LZO	85	457,960
WA	KE7C	85	57,405

DX Stations—Single Operator:

Balearic	EA6VQ	85	23,790
Bermuda	VP9KA	85	71,530
Bulgaria	LZ1KOZ	85	18,900
Chile	CE4ETZ	86	11,400
Czech.	OK1RI	86	441,600
England	G4XOM	86	15,640
Honduras	HR1FC	85	11,160
Indonesia	YCØSY	86	5,360
Israel	4X6IF	86	16,170
Italy	IK2GSN	86	38,130
Japan	JP1GLV	86	26,640
Korea	HL1ABR	86	2,500
New Caledonia	FK8FA	86	21,700
Nigeria	JG1FVZ/5NØ	86	223,720
Philippines	WA7CQE/DV2	86	80,460
Portugal	CT1TM	85	4,900
So. Africa	N4NW/ZS	85	38,675
Spain	EA3BOX	86	89,440
UN HQ	4U1UN	85	13,225
Virgin Is.	N4CIS/KP2	86	54,120

DX Stations—Multi-Operator:

Hawaii	KH6DW	86	333,575
Japan	JA3YBF	85	23,205

Table 4. 15-meter honor roll—all-time record holders. (Columns show QTH, callsign, year, and score.)

WD5GSL (40), VE3BVD (39), and KH6DW (34). Believe me, it was tough!

DX multipliers were just as scarce. While many DX stations were on, old Sol just would not allow signals to take more than a couple hops. Stations fortunate to work 30 or more DX countries included: KM5X (67), OK1RI (65), K5LZO (59), NR5M (56), JG1FV/5NØ (46), VE3BVD (44), WD5GSL (38), KS9O (36), and KC2EE (33).

We have taken a survey of the various antennas used during the 15-meter contest and calculated the percentages. Here are the results:

3-element triband yagi	18.0
4-element triband yagi	10.3
4-element monoband yagi	10.3
Trapped vertical	8.6
Inverted vee, dipole	6.8
Vertical	6.8
6-element triband yagi	5.1
7-element monoband yagi	5.1
G4ZV/G5RV	5.1
Longwire	3.4
3-element monoband yagi	3.4
5-element monoband yagi	3.4
6-element monoband yagi	3.4
4-element monoband quad	3.4
3-element monoband quad	1.7
6-element monoband quad	1.7
2-phase rotatable helical verticals	1.7
13-element log periodic	1.7

If the contest scores don't have you envious of the winning stations, then perhaps the equipment survey in Table 3 will get your mouth to watering.

To many, the contest meant adding a new country to their DX country totals or their Worked All Zones. To others it meant their 50th state for WAS. We saw a few contest records broken and some new records established. Refer to Table 4, the honor roll list of all-time record holders.

On behalf of contest chairman Gary Vest NW5E, we thank each of you who took the time to get on the air during adverse band conditions. Without you, the contest would not have taken place. We appreciate your dedication and promise you it will pay off when the sun spot cycle does a 180-degree turnaround. You are certainly the deserving few who know what contesting is all about. ■

15-METER SOAPBOX

4X6IF	Band conditions were superb here! Family commitments allowed me to operate only a few hours, though. See you next year.
JA1AAT	Conditions no good, only Asia and Oceania stations heard.
JL1MWI	No good conditions in Japan!
JR5HCU	It was a great pity that I could not contact with any U.S. stations. Band no good today.
KC2EE	I really enjoyed the contest.
KJ4LU	Thanks for FB contests. Played around on 15 just to get ready for the 20-meter contest. Almost did better on 15 than I did on 20, though. Heard no stateside on 15 in a two-hour period. Band was pretty bad.
KD5RW	Good conditions. Had rig trouble and overheating amp.
KM5X	Thanks for Europe, it was fun!
NF2C	Conditions poor. Very few openings anywhere. Thanks for the test and see you next time.
NJ7A	With random wire and running barefoot . . . if you can't hear them, you can't work them; if you can't work them, they can't work you!
OK1RI	Difficult to get contest results here!
W4WKQ	I enjoyed the short 15-meter opening. Wish conditions had been better, though.
W5IYX	The low solar flux is still hurting the contest. Just a bare European opening at times. In a few more years this should be a very good event. [Roger that!—KE7C]
WA7CQE/DV2	First time for this contest. I really enjoyed it. Wish more would play but still appears to be picking up since last year's contest. Thanks, *73*!

1986 15-METER WORLD SSB CHAMPIONSHIP

Callsign, QTH, QSOs, states and provinces, DX countries, total score
** = World Champions; * = State, Province, Country Champions

W/VE—Single Operator:

** KM5X	TX	548	49	67	458,780
* NR5M	TX	540	50	56	378,950
* VE3BVD	ONT	404	39	44	225,640
* KS9O	IL	264	31	36	136,680
KC2EE	TX	254	44	33	122,815
W5PWG	TX	181	33	23	56,560
* K7QQ	WA	157	33	16	48,755
* W4WKQ	FL	157	25	20	40,500
* WA6FGV	CA	140	18	9	20,250
K6XO	CA	75	16	15	14,415
KJ4LU	NC	74	0	19	14,060
KVØI	NE	55	16	14	10,800
WK4F	FL	39	11	19	8,700
K3ZO	MD	31	5	13	4,590
WD8DVX	OH	28	9	9	3,870
W3SOH	VT	33	7	12	3,800
K4GKV	GA	22	5	12	3,145
W3ARK	PA	27	1	11	3,120
N5AFV	TX	27	8	10	3,060
KX2J	NY	26	11	7	3,060
WA5IYX	TX	31	9	7	3,040
WØIZV	CO	21	9	8	2,635
W5EIJ	AR	13	2	7	720
W9REC	IL	12	4	4	680
NJ7A	UT	13	4	4	640
NF2C	NJ	11	3	2	275
WØNGB	MN	5	0	4	200
VE8RCS	NWT	7	0	4	140

DX—Single Operator:

** OK1RI	Czechoslovakia	518	31	65	441,600
* JG1FVZ/5NØ	Nigeria	333	22	46	223,720
* EA3BOX	Spain	187	32	20	89,440
* WA7CQE/DV2	Philippines	461	0	18	80,460
EA7AVU	Spain	167	32	16	68,460
* N4CIS/KP2	Virgin Is.	237	34	10	54,120
* IK2GSN	Italy	103	24	17	38,130
* JP1GLV	Japan	163	2	22	26,640
* FK8FA	New Caledonia	226	4	6	21,700
I4CSP	Italy	56	20	15	17,675
EA5FCP	Spain	78	22	1	16,200
4X6IF	Israel	94	1	20	16,170
G4XOM	England	57	14	20	15,640
CE4ETZ	Chile	57	19	1	11,400
JL1MWI	Japan	101	1	16	10,890
OK1TW	Czechoslovakia	41	11	16	9,620
JR5HCU	Japan	114	0	13	9,230
4X4FL	Israel	40	12	22	9,120
YCØSY	Indonesia	37	0	16	5,360
JA2BNN	Japan	63	0	11	4,235
EA3CHI	Spain	29	0	14	2,800
JE7HFQ	Japan	34	0	11	2,585
HL1ABR	Korea	43	0	9	2,520
OK1KZ	Czechoslovakia	22	5	8	2,275
EA5EFV	Spain	17	9	5	2,100
CT1DIZ	Portugal	17	1	12	1,495
OK2BHO	Czechoslovakia	9	4	4	680
JH3DEJ	Japan	8	0	5	400
JE1TTO	Japan	6	0	4	180
CT1AHC	Portugal	3	2	1	90
JA1AAT	Japan	6	0	2	90
JM3XHD	Japan	3	0	2	40
JO1MCC	Japan	2	0	2	40

W/VE—Multi-Operator:

** K5LZO	TX	521	48	59	384,665
* KD5RW	LA	298	42	28	134,050
* WD5GSL	TX	228	40	38	114,270

DX—Multi-Operator:

** KH6DW	Hawaii	618	34	21	333,575
* JA2YEF	Japan	131	1	18	15,865
JA9YBA	Japan	102	0	10	6,150
JA2YDC	Japan	2	0	2	30

(Checklogs—By request: EA3CTI, EA3PE, KJ4NC, OZ1DPW, VO1OP; checklogs—Late entries: 4Z4TR, AH6EK, DL6FBL, JA1YAG, JA7YCQ, K5GN, OH7EU.)

Multi-Operator Participants:

JA2YDC	Aichi Institute of Technology, JE2EZO, JI2RIG
JA2YEF	Chuba University Radio Club, JF2NFC, JF2QHC, JI2LPD, JI2QVF, JJ2VAI, JJ2VFE, T. Yamamoto
JA9YBA	Kanazawa University ARC, JA9LNJ, JA9VDA, Kony Hirosh, Mia Takasi
K5LZO	K5LZO, KE5IV, NM5M, NT5D
KD5RW	KD5RW, KA5DLM, KA5BOO
KH6DW	KH6DW, K7SS
WD5GSL	E-Systems ARC, WBØTEV, WD5ABC, WF5C, KA5YDC, KA5YFI, KA5WHY

NEVER SAY DIE

from page 14

WA6ITF presenting the Westlink Young Ham of the Year award to Shawn Wakefield WK5P. We'll have more in *73* about the winner, so I won't go over that here. But anyone who still thinks we're losing youngsters because they have too many other interests attracting them—instead of admitting that our blind insistence on Morse code is killing amateur radio—needs to see what this chap has been doing.

I think it was Roy who brought up the simile of old men in a lifeboat stamping on the fingers of those trying to get in. Apt.

There is one aspect of Las Vegas that I do enjoy—the buffets. My, oh my, they've developed those into an art form. Back in the Saroc days I remember one hotel with a buffet; now they're from one end of the strip to the other—and downtown, too. The lunch prices run from $2.50 to around $4 and some are great. Of course, I suppose I'd class any buffet which ends up with an ice cream machine and buckets of sundae toppings as great. Who needs the buffet?

One of the locals cued me into an Italian buffet in the shopping mall on the strip. Unfortunately I didn't quite get that far, being stopped by the Oasis Hotel buffet. No complaints. Maybe next time I'll make it.

The Imax theater in Caesar's Palace was closed for another week. I hate to miss an Imax—spectacular shows.

Get your priorities straight and plan to get to Ham/West next November. The weather will probably be beautiful—around 80 degrees again, while snow and bitter cold hit much of the rest of the country. The show is well managed—the ham dealers are there with good prices—the flea market will load you down with stuff you can't afford not to buy—and Vegas is there to entertain you—make you fat—and suck you dry.■

PROPAGATION

Number 23 on your Feedback ca

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15[1]	15[1]
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15[1]	15[1]
INDIA	[illegible]					20[1]	40[1]	20[1]				15[1]
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40[1]	40[1]				15	15	15	20	20
U.S.S.R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15[1]	20[1]	20[1]				40[1]	20[1]	20[1]			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*							15	15	20	20
U.S.S.R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40[1]	40[1]							15	15	20
U.S.S.R.		40[1]	40[1]	40[1]	40[1]				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

1 = May be open only once or twice during month.
*** = Try next higher band.**

G = Good, F = Fair, P = Poor.

The period of the 14th through the 17th is especially disturbed due to magnetic storm conditions.

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
1 F	2 F–G	3 G	4 G	5 G	6 G	7 G–F
8 F	9 F–G	10 G	11 G	12 G–F	13 F	14 P
15 P	16 P	17 P–F	18 F–G	19 G	20 G	21 G–F
22 F–P	23 P	24 P–F	25 F–G	26 G–F	27 F	28 F

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	$10.37

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TEAK ROLL TOP #453 3.5 (90)	$24.67
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TF 100 TRACTOR FEED	$109.85
TF 300 TRACTOR FEED	$109.85
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KB 100 KEYBOARD 150	$194.35
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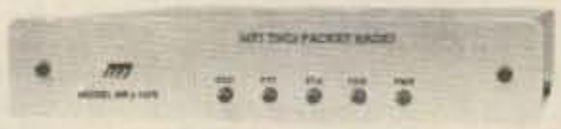

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- **VS-1 voice synthesizer (optional)**
- **Superior receiver dynamic range**
  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m)
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  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB, 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)

- **Adjustable dial torque**
- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**
  Subtone is memorized when TU-8 is installed.
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
- **MC-43S UP/DOWN mic. included**
- **Computer interface port**
- **5 IF filter functions**
- **Dual SSB IF filtering**
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **VOX, full or semi break-in CW**
- **AMTOR compatible**

Optional accessories:

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- AT-250 external auto. tuner (160 m—10 m)
- AT-130 compact mobile antenna tuner (160 m—10 m)
- IF-232C/IC-10 level translator and modem IC kit
- PS-50 heavy duty power supply
- PS-430/PS-30 DC power supply
- SP-430 external speaker
- MB-430 mobile mounting bracket
- YK-88C/88CN 500 Hz/270 Hz CW filters
- YK-88S/88SN 2.4 kHz/1.8 kHz SSB filters
- MC-60A/80/85 desk microphones
- MC-55 (8P) mobile microphone
- HS-5/6/7 headphones
- SP-40/50B mobile speakers
- MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount
- TL-922A 2 kw PEP linear amplifier
- SM-220 station monitor
- VS-1 voice synthesizer
- SW-100A/200A/2000 SWR/power meters
- TU-8 CTCSS tone unit
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